Database Technology Professional (DBTech Pro) Project
WP6 - Assemble of the DBTech Pro Certificate

Final Report:

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1 Introduction

The database is now the underlying framework of the information system and has fundamentally changed the way many organisations and individuals work. This is reflected within tertiary education where databases form a core area of study in undergraduate and postgraduate programmes related to computer science and information systems, and typically at least an elective on other data-intensive programmes (ACM/IEEE 2001; EUCIP 2003). The core studies are commonly based on the relational data model, SQL (the de facto language for relational DBMSs), data modelling and relational database design. This curriculum initially supported industry needs where the relational DBMS was the dominant data-processing software. At the same time, the field of computing has seen significant developments over the last decade with object-orientation becoming much more predominant and the Web emerging as a global communication and business medium. Database technology has encompassed these new developments with the emergence of object-relational DBMSs, object-oriented DBMSs, support for Web-database integration, HTML, XML, XQuery, Java, J2EE, data warehousing, business intelligence, and so on. These developments have significantly increased the breadth and depth of knowledge that a modern database professional requires to work effectively in industry.

The Database Technology Professional (DBTech Pro) project is an EU, Leonardo da Vinci Program Project involving the participation of academic and industrial partners from the Database Technology Network (DBTechNet) initiative [1] that is investigating how academia can better support the needs of the database community. The partnership extends across five EU member states (Finland, Germany, Greece, Spain, UK) and involves seven academic institutions: Hochschule Reutlingen, Germany; Häme Polytechnic, Hämeenlinna, Finland; Helia (Helsinki Business Polytechnic), Helsinki, Finland; TEI of Thessaloniki, Greece; University of Macedonia, Thessaloniki, Greece; University of Malaga, Spain; University of Paisley, UK; and three companies: ALTEC S.A., Thessaloniki, Greece; Solid EMEA North, Helsinki, Finland; TietoEnator Public Sector, Espoo, Finland. The project aims include:

(a) the identification of professional roles and skills in relation to contemporary database technology practice in Europe;
(b) for each one professional role identified, the specification of the knowledge and skills that are needed by the individual who wishes to achieve competency in the relevant job market;
(c) the development of pilot course and laboratory workshop material for training and, subsequently, testing the knowledge and skills in question; '
(d) an investigation into the possibility of developing a vendor-
independent European certificate of Database Technology   Professional.

In this respect, the goals of the DBTech Pro project are along the lines of, and complementary in nature to, those of the broader industry-driven, vendor-independent professional certification and competency development initiatives (e.g. EUCIP) that target the database professional and practitioner. Direct beneficiaries of the project include:

- Students studying their degree in the partner institutions will obtain basic knowledge and skills as a database professional for employment opportunities both with national and international enterprises.
- Enterprises will be assisted to catch-up with the rapid pace of developments in database technology, assess and adapt to the existing databases. In this respect, they will avoid pitfalls and they can employ highly trained and competitive staff. The proposed European DBTech Pro Certificate for a database expert will guarantee the quality of knowledge and the competence in modern database technology of the employees. In a larger scale this will benefit the competitiveness of the whole European industry on worldwide markets, since professional use of databases is the foundation of all information systems.
- Database professionals in SMEs having the proposed European DBTech Pro Certificate can prove their knowledge and skills – and their value in the labour market.
- Educational institutions will combine their human and technical resources and thus get better results for all their staff members and students.

To enable the efficient and effective organisation of the collaboration across the partner institutions, the project has been decomposed into a number of work packages:

WP1: Project Management
–   to oversee the effective and efficient organisation of the project.

WP2: Specification of Knowledge Areas
–   to determine the knowledge areas required by a European Database Technology professional.

WP3: Specification of Teaching Practices and Laboratories, Pilot Tests
–   to determine what teaching modules and laboratories exist across the partners, and to identify and develop four pilot workshops during the project.

WP4: Content Planning
–   for each the knowledge areas identified in WP2, compile an initial version of educational/course content outline, indicative of the database technology knowledge and skills to be assessed for professional competence in the job market.

WP5: Pilot Run of the DBTech Pro
–   to establish pilot runs of the four workshops that will be created during this project among the partner organisations.

WP6: Assembly of the DBTech Pro Certificate
–   to make recommendations on the industry support for a vendor-independent certification scheme for a European Database Technology professional.

WP7: Evaluation and Assessment
–   to evaluate the project overall and the four pilot workshops to be created during the project.

WP8: Dissemination
–   on an on-going basis, to disseminate the results of the project.

WP9: Workshops Planning and Organisation
–   to plan and organise the four pilot workshops to be developed during this project.

2 Work Package 6: Description, Tasks and Actions

The name for the Work Package 6 is defined as "**Assemble of the DBTech Pro Certificate**". The corresponding leader is Georgios Evangelidis from the University of Macedonia, Greece, and the schedule for the development of this package is
1 December 2002 – 31 May 2005. The outcomes have been defined as follows:
1.   Report and suggestion for DBTech Pro professional certificate
2.   Information exchange-report between SWEBOK and other on-going activities in knowledge area workgroups.

According to decisions made during DBTech meetings in Thessaloniki (16 May 2003) and in Helsinki (18 April 2005), the outcomes are further clarified and determined as follows:
3.   Investigation results for the current situation for DB certification
4.   Certification framework/specs (if appropriate)
5.   WP6 report will be printed in English
6.   A short summary of the WP6 report will be written in Spanish, Greek, German and Finnish and published in the Internet.

For the purpose of reporting and suggesting for the DBTech Pro professional certificate in Database Technology (outcome 1 further clarified by outcomes 3 and 4), four actions were performed:
➢   A survey of database certifications
➢   Quantitative analysis based on WP2 questionnaire responses
➢   Qualitative analysis based on interviews of selected DB related professionals
➢   A suggestion about the framework-specifications of certification
     (if appropriate)

By performing the first three actions, the landscape of DB certifications was expected to become clearer and one could obtain indications of whether a vendor-independent European DB certification scheme proposed by "DBTech Pro" could be complementary and competitive to the existing DB certifications. If the results indicated so, a framework and/or specifications of such a certification could be based on the experiences gained from work packages WP2, WP3 and WP4.

For the purpose of information exchanging/reporting between SWEBOK and other on-going activities in knowledge area workgroups an opened and on-going discussion has taken place between SWEBOK and the project and it will continue with the DBTechNet.
Finally, this report will be printed in English (outcome 5) and its summary will be written in Spanish, Greek, German and Finnish and published in the Internet (outcome 6).

3 A Survey of Database Certifications

The survey of database certifications was conducted mainly through Internet from September to December 2003. Many valuable sources were found with relative information such as online magazines, articles about DB certifications from experts, surveys, job market research, etc. For example, a very interesting source was the *Certification Magazine* (http://www.certmag.com).

3.1 General Comments on the Findings

The current situation with regard to Database skills certification is dominated by vendor/product specific programs as it was expected. Although working with a Database Management System requires theoretical and practical knowledge of Database concepts, it is unavoidable to be involved with a specific product, which demands deep and thorough knowledge of the corresponding platform, the numerous and specialized tools or utilities and all the technical implementations within a real world environment. From all certification programs that we reviewed very few were vendor/product neutral providing various tests for verification of general knowledge. Namely, Brainbench organization evaluates and assesses skills and knowledge through a series of exams to qualify employees for specific

job roles. In particular, for the database job role a candidate must verify his/her knowledge of basic database vendor independent concepts such as Data Modeling, RDBMS, SQL e.t.c. Field Certified Professional Association (FCPA) also offers vendor – independent certifications for individuals who wish to demonstrate their skills as database administrators or database developers by giving exams, which are most of them vendor-independent. Of course, working knowledge of some specific products or platforms is required in both programs. Thus, an individual who is interested in Database field could get herself or himself started the certification journey from either organization to obtain basic knowledge or a "prerequisite" certification for other vendor/product specific certification.

Certifications may involve taking a single test or series of exams, attending courses and/or hands-on training. The latter is the toughest form of exam because the candidate must demonstrate his/her skills and knowledge on real-world (or simulated) systems and hardware situations.   For example, Oracle9i Database Administrator Certified Master (OCM) requires a two-day practicum exam. Moreover, there are some programs that require mastering an enormous amount of technical details or having many prerequisites such as HP Master Accredited Systems Engineer (MASE). The former highest-level Compaq certification requires multiple HP/Compaq and third-party certifications as prerequisites. Also, the majority of credentials require some kind of recertification as part of continuing education or due to frequent releases of new product-specific versions.

3.2 Database Related Job Roles

The majority of the available programs fall into an intermediate or advanced level of difficulty mainly because of the complexity of Database Management Systems that necessitate the involvement of many different responsibilities, skills and many different job roles. Obviously, these roles do not all fall completely into the Database field but all of them contribute to the effective function of a Database Management System. Most of the vendors base their certifications on specific **job roles or titles** some of which are referred below:

- Authorized Engineer
- Database Administrator
- Database Professional
- Database Designer
- Database Specialist
- Database Developer
- Solution/Application Developer
- Solutions Expert
- Implementation Specialist
- Technical Expert

3.3 Database Related Certifications

Tables 1(a) and 1(b) presents several database related certifications and the corresponding organizations. More information for each program is provided to the next section. This list is not inclusive.

ORGANIZATION	CERTIFICATION
ADAPTEC, Inc.	➢ Adaptec Certified Storage Professional (ACSP)
BRAINBENCH	➢ Various exams ➢ Database Administrator ➢ Other related exams
CIW	➢ Certified Internet Webmaster (CIW) Professional
Crystal Decisions	➢ Authorized Crystal Engineer (ACE)
Field Certified Professional Association	➢ Field Certified Database Administrator (FCDBA) ➢ Field Certified Database Developer (FCDBD)
HP Certified Professional Certification Program	➢ Master Accredited Systems Engineer (MASE-ASE) ➢ Oracle on Tru64 UNIX ➢ Oracle on Windows ➢ SQL Server
IBM Professional Certification Program	➢ IBM Certified Database Associate ➢ IBM Certified Database Administrator ➢ IBM Certified Advanced Database Administrator ➢ IBM Certified Advanced Technical Expert ➢ IBM Certified Specialist -or- IBM eServer Certified Specialist ➢ IBM Certified Solutions Expert -or- IBM eServer Certified Solutions Expert
Learning Tree International	➢ SQL Server 2000 DBA Certified Professional ➢ SQL Server Application Development Certified Professional ➢ Oracle9i DBA Certified Professional ➢ Oracle9i Application Development Certified Professional ➢ Oracle8i DBA Certified Professional ➢ Oracle8i Application Development Certified Professional ➢ Acccess Certified Professional

Table 1(a).   Database Related Certifications

ORGANIZATION	CERTIFICATION
MICROSOFT	➢ Microsoft Certified Database Administrator (MCDBA) ➢ Microsoft Certified Solution Developer (MCSD)
MySQL	➢ MySQL Core Certification ➢ MySQL Professional Certification
ORACLE	➢ Database Administrator ➢ Oracle8i Certified Professional ➢ Oracle9i Upgrade from DBA OCP ➢ Oracle9i Certified Associate, Professional and Master ➢ Application Developer: ➢ Oracle Forms 6i Developer Certified Professional ➢ Oracle9i PL/SQL Developer Certified Associate and Forms Developer Certified Professional ➢ Oracle9i Forms Developer OCP Upgrade Path
PERVASIVE	➢ Certified Pervasive Developer ➢ Certified Pervasive Technician
SYBASE	➢ Adaptive Server Administrator Associate/Professional ➢ Replication Server Administrator ➢ EAServer Developer Associate ➢ Enterprise Portal Developer ➢ PowerBuilder Developer Associate/Professional ➢ SQL Developer Associate
TERADATA	➢ Teradata Certified Professional ➢ Teradata Certified Implementation Specialist ➢ Teradata Certified SQL Specialist ➢ Teradata Certified Administrator ➢ Teradata Certified Designer ➢ Teradata Certified Application Developer
U2TEST	➢ Various exams ➢ CRM CONCEPT ➢ E-BANKING CONCEPT ➢ ECOMMERCE CONCEPT ➢ EMERGING TECHNOLOGIES ➢ ERP CONCEPT ➢ INFORMATION SYSTEM MANAGEMENT ➢ LOTUS NOTES DOMINO R-5 ➢ MIS CONCEPT ➢ ORACLE 8 PL/SQL ➢ ORACLE 8 (DBA) ➢ SQL SERVER 7

Table 1(b). Database Related Certifications, continues

3.4 Description of Database Related Certifications

A brief description of each database related certification program is provided in
Appendix A   The reader should visit the corresponding sites, from which this
information was obtained, for more accurate and complete details for each
certification program. Some more detailed information regarding lists of
courses, exam contents or descriptions of specific courses is provided in six
appendices. More specifically:

Appendix A1 includes the list of core and elective courses that BRAINBENCH
program offers for the Database Administrator job role.

Appendix A2 includes the objectives/skills measured on various tests for IBM
certified Database Administrators.

Appendix A3 presents the outline for the vendor – independent course
"Relational Databases: Design, Tools and Techniques" that is offered by
LEARNING TREE INTERNATIONAL.

Appendix A4 includes the exam contents of MySQL certifications.

Appendix A5 provides a list of ORACLE courses that are offered as part of the
certification process.

Appendix A6 shows the exam preparation guide of TERADATA certifications

4 Quantitative Analysis Based on WP2 Questionnaire Responses

4.1 Work Package 2: Methodology

"The survey was designed as a collaborative effort by the entire team and an online version of the survey was implemented on the DBTech Pro web site. The survey was carried out in each country using a slightly different approach that took account of country differences. In the UK, the West of Scotland was used as a representative region of the UK and this region then used for sampling. A total of 212 surveys were sent out to a representative sample to cover all business sectors and 70 returns were received. In Finland with a smaller number of relevant companies to survey, specific companies were selected and the survey sent to a member of each one. For Finland, 50 responses were received. For Greece, the survey was distributed to 150 companies were selected but only 9 responses received. For Spain, the survey was distributed to 517 companies were selected but only 3 responses received. For Germany, the survey was distributed to 300 companies but only 15 responses received. Due to the low response from Greece, Spain

and Germany, the analysis was based on the responses from the UK and Finland. The survey is provided an appendix to this document." [WP2 Final Report]

4.2 Work Package 2: Certification Related Results

Taken from the WP2 Final Report:

"Q9: Please specify the approximate number of staff who have the following database vendor certification.

Table 2 summarizes the returns from this particular question. Five particular certifications were identified in the returns: Oracle, Microsoft, IBM, Sybase, and, surprisingly, MySQL. The first two were the main certification schemes for staff. This represents about 8.7% of all database staff in the companies (which seems quite high).

Q9 - Database Certification	
Oracle	41.6%
MS	33.5%
IBM	19.0%
Sybase	4.5%
MySQL	1.4%

Table 2. Number of Staff with Database Certification

Q10: Do you consider database vendor certification to be important for staff?

Table 3 summarizes the returns from this particular question. The data would suggest that industry is not that concerned about the existing certification schemes, with a slight preference for certification.

Q10 - Importance of Certification	
Not Important	27.8%
Neutral	28.7%
Somewhat Important	38.9%
Very Important	4.6%

Table 3. Importance of Certification

Q11: Would you prefer to see a vendor-independent certification scheme for database professionals?

Table 4 summarizes the returns from this particular question. There seems to be clear evidence that there is a desire for an independent certification scheme with more than 80% in agreement and less than 3% in disagreement.

Q11 - Independent Certification	
Strongly Disagree	0.9%
Somewhat Disagree	1.9%
Neutral	15.0%
Somewhat Agree	51.4%
Strongly Agree	30.8%

Table 4. Prefer to see a vendor-independent certification" [WP2 Final Report]

4.3 The Three "Interesting" Contingency Tables

Although this survey was carried out in each country independently, the results in previous section were drawn from analysis that was based only on the responses from the UK and Finland, due to the low response rate in Greece, Spain and Germany.
Some further analysis was performed on the raw data that came from the questionnaire responses with regard to "Database Certification". Minor differences in results between these two sections are due to different pre-processing approaches.

Table 5 summarizes how important the certification is considered in each country. It seems that in UK certification is considered less important than in Finland and Greece. In the majority of UK responses (44%) certification is considered as "not important" while in the majority of Finland responses (49%) is considered as "somewhat important". Similar results with Finland appear in Greece (67%), while there is not any clear preference in Deutschland and Spain; the sample sizes are very small though.

Certification Importance	Statistics	Country					
		DE	ES	FI	GR	UK	Total
not important	Count	3	1	5	2	21	32
	% of column	33%	33%	12%	22%	**44%**	29%
neutral	Count	3	1	12		15	31
	% of column	33%	33%	29%	0%	31%	28%
somewhat important	Count	3	1	20	6	12	42
	% of column	33%	33%	**49%**	**67%**	25%	38%
very important	Count			4	1		5
	% of column	0%	0%	10%	11%	0%	5%
Total	Count	9	3	41	9	48	110
	% of column	100%	100%	100%	100%	100%	100%

Table 5. Certification Importance by Country

Table 6 summarizes the attitudes towards the need of an independent certification by country. Responses from UK and Finland are clearly positive. 87% of UK and 68% of Finland respondents are positive. The difference in these two numbers is due to the fact that one out of three UK respondents "strongly agree" with the need of an independent certification program while in Finland the corresponding proportion is one out of ten.

Independent Certification	Statistics	Country					
		DE	ES	FI	GR	UK	Total
strongly disagree	Count	1		1	1		3
	% of column	11%	0%	3%	11%	0%	3%
somewhat disagree	Count			3	1		4
	% of column	0%	0%	8%	11%	0%	4%
neutral	Count	2	2	9	4	6	23
	% of column	22%	67%	23%	44%	13%	21%
somewhat agree	Count	4		23	2	26	55
	% of column	44%	0%	**58%**	22%	**54%**	50%
strongly agree	Count	2	1	4	1	16	24
	% of column	22%	33%	**10%**	11%	**33%**	22%
Total	Count	9	3	40	9	48	109
	% of column	100%	100%	100%	100%	100%	100%

Table 6. Need for Independent Certification by Country

Table 7 associates the two main issues of the survey regarding the "Database Certification". It seems that there is a need for an vendor independent certification program. It is interesting to see that 82% of those who consider certification as "not important", they "somewhat agree" or "strongly agree" with the need of an independent certification. Furthermore, from those who "strongly agree" with an independent certification, 54% consider certification as "not important", 21% as "somewhat important" and only 4% as "very important".

| Certification Importance | Statistics | Independent Certification | | | | | |
		strongly disagree	somewhat disagree	neutral	somewhat agree	strongly agree	Total
not important	Count			6	13	13	32
	% of row	0%	0%	19%	**41%**	**41%**	100%
	% of column	0%	0%	23%	23%	**54%**	28%
neutral	Count		1	14	13	5	33
	% of row	0%	3%	42%	39%	15%	100%
	% of column	0%	25%	54%	23%	21%	29%
Somewhat important	Count	2	3	6	27	5	43
	% of row	5%	7%	14%	63%	12%	100%
	% of column	67%	75%	23%	48%	**21%**	38%
Very important	Count	1			3	1	5
	% of row	20%	0%	0%	60%	20%	100%
	% of column	33%	0%	0%	5%	**4%**	4%
Total	Count	3	4	26	56	24	113
	% of row	3%	4%	23%	50%	21%	100%
	% of column	100%	100%	100%	100%	100%	100%

Table 7.Certification Importance by Need for Independent Certification

5 Qualitative Analysis Based on Interviews of DB Related Professionals

A qualitative research was conducted from January to May 2005 by e-mailing a list of DB certification related questions to DB related professionals. The main purposes of this survey were to investigate in greater depth the importance of being DB certified from the professionals' point of view and to obtain more feedback about the need of a vendor-independent DB certification. The questions of this survey were the following:

1. Do you believe that organizations should require that new employees (database professionals) possess some DB certification?
2. Do you find adequate the level of DB knowledge offered by a typical university degree in computer science or informatics?
3. Do you think that organizations could benefit and reduce the cost of in-house training by employing certified DB professionals?Most of the Database certification programs are vendor/product specific programs since working with a DBMS demands deep and thorough knowledge of the corresponding platform, the

specialized tools and utilities of the specific product. However, do you believe mthat an organization should have their employees acquire a vendor/product neutral certification program to verify higher-level knowledge of DB concepts?

The sample of DB-related professionals was non-random. The selection of each person to be interviewed was based upon at least one of the following rules:
- being DB related professionals (from diverse Database Technology areas)
- representing DBTech partners - companies
- having a strong academic and/or professional background/experience

Furthermore, not all persons should come from the same country.

Eventually, there were 14 respondents. The order by which they are referred is random.

NIKOS AGATHONIKOS (NA)	Manager Services	METROPOLIS	Greece
RISTO NEVALAINEN (RN)	Process expert, Managing director	Software Technology Transfer	Finland
ADAMANTIOS KOUMPIS (AK)	Head of the Research Programmes Division	ALTEC	Greece
ECKART MADER (EM)	Senior Sales Consultant	ORACLE	Deutschland
JANNE JÄRVINEN (JJ)	Director Research and Development	Solid EMEA North	Finland
ATHANASIOS STAMOULIS (AS)	DB Developer	LearninG PLAN	Greece
JORG HENNE (JH)	CEO	Levigo	Deutschland
PIRJO SALO PS)	DBA	TietoEnator	Finland
SARI-ANNA KOSUNEN (SAK)	Expert	TietoEnator	Finland
LASSE AKSELIN (LA)	Team Leader	TietoEnator	Finland
ERKKI JAAKKOLA (EJ)	DBA	TietoEnator	Finland
ARI RUSANEN (AR)	DBA	TietoEnator	Finland
JOUNI RIIKONEN (JR)	Manager	TietoEnator	Finland
LIISA HALMEENMÄKI (LH)	IT Architect	TietoEnator	Finland

Table 8. Table of Respondents

5.1 Results of Qualitative Analysis

An attempt to interpret and summarize the responses was made and the report is being presented below. Specific comments or opinions have been written without referring the corresponding person's name but the whole interview (answers) is included in the next section 5.2 by question and by person.

Questions were short and one of them was a "leading" one as one respondent mentioned. However, that did not affect any person's opinion. Although the answers that professionals gave were brief as they were asked to do, taken altogether they were very interesting and revealing. In particular:

Question 1. Do you believe that organizations should require that new employees (database professionals) possess some DB certification?

Almost all of the respondents, thirteen (13) out of fourteen (14) at least agreed that possession of a certification (relevant to the current needs) by an employee is always a benefit for the corresponding organization, especially when a specific product is being utilized. Six (6) of them were absolutely positive, five (5) of them were positive under specific conditions related to the current needs of a company (e.g., the specific job position, the specific product that is being utilized, etc.), and, two (2) of them considered DB certification as "a good thing to have" but not as a strict requirement. An interesting comment was made by one (1) professional, who claimed that a DB certification should be required even for other IT professionals in order to have a minimum common background, cooperate more efficiently and improve the performance of the final product.

Question 2. Do you find adequate the level of DB knowledge offered by a typical university degree in computer science or informatics?

Out of fourteen (14) persons, seven (7) answered negatively, four (4) said that this depends, especially with regard to the practical/laboratory experience that a student gains from his/her studies and two (2) answered positively. However, the two "positive" responses do not necessarily contradict the other responses since they consider a university degree as a "good starting point" and not as a proof of adequate DB knowledge in practical issues. More than half of them stated that universities offer "high level of theoretical knowledge and/or very low experience in practical issues". In addition to that, two (2) persons mentioned that the level of DB knowledge offered varies substantially among educational institutions (universities, technological institutes, etc.).

> **Question 3.** Do you think that organizations could benefit and reduce the cost of in-house training by employing certified DB professionals?

Respondents approached this question differently. Eight (8) persons said that employing certified DB professionals could reduce (at least merely) cost of in-house training (under specific conditions). One (1) person said that the savings would not be essential. Four (4) persons focused on the benefits that could be gained indirectly by "doing the work better" (operational costs). Finally, one (1) professional claimed, "If the aim is to hire only certified DB professionals so that you don't have to train them any more (because they already know everything) I think it's not from this world".

> **Question 4.** Most of the Database certification programs are vendor/product specific programs since working with a DBMS demands deep and thorough knowledge of the corresponding platform, the specialized tools and utilities of the specific product. However, do you believe that an organization should have their employees acquire a vendor/product neutral certification program to verify higher-level knowledge of DB concepts?

This question is very important concerning the objectives of WP6. Eleven (11) out of fourteen (14) answered positively, and three (3) answered negatively. The main arguments for "yes" are: (a) the fact that the DB concepts are not vendor/product specific and "higher expertise calls for understanding beyond specific vendor tools" and (b) that someone who is deeply aware of these concepts easily adopts a new product. The basic arguments for "no" is that (a) most organizations work with a specific DBMS and (b) most of the DB employees have a good basic-level knowledge of DB concepts. Last but not least, a DB professional stated that "this is already happening to some extend" as part of the SWEBOK concept.

5.2 The Actual Responses

The professionals are referred with their initials. Their answers have been copied from their messages as they were, after correcting some typing errors.

> **1.** Do you believe that organizations should require that new employees (database professionals) possess some DB certification?

NA:

If the organisation is using a specific database then certification on the specific product is always a plus, as the employee can be productive with minimum effort. If the organisation is not using the specific product a certification would rather be of the same weight as general but strong DB knowledge

So if the organisation needs asap a specialist at a high appointment level (i.e. Senior IT Manager) for a specific DB product then it would be of benefit to find a certified engineer with the specific certification. If on the other hand it needs to recruit a Junior IT specialist who will learn the specific DBASES of the organisation according to the principle "learn by doing", general DB knowledge would be more cost-effective. This especially, when the organisation is using various DB architectures and vendors.

RN:
Sure, but not quite "new" ones. But when somebody has been working for a company for 1-3 years, then the person is fully qualified to participate in customer projects and then a DB certification is relevant.

AK:
Certification is useful only if the certifying authority has some credibility. For this, a company or organisation should be very cautious in the type of certifications it would consider as valid. Especially regarding database professionals, a high score in the related lecture or previous professional experience are higher appreciated than a certificate from a non-accredited authority.

EM:
For organisations who want to hire professionals for the administration of databases, I think they would favour people with a certificate. In addition, my opinion is that they would not differentiate between a neutral and a vendor certificate.

JJ:
I am not in favor of strict requirements like this. However, I think it would be a definite advantage if a job applicant would have some DB certification. This way it would be easier to assess job applicants' capability.

AS:
Absolutely yes. Even if they work only as administrators.

JH:
Yes, I do, but I would not restrict it to "database professionals", i.e. specialized database folks. All application developers, software architects etc. will at some point have to deal with data organization and storage. My experience teaches me, that separating database skills from general application development skills may lead to problems during the late implementation phase of projects: as soon as problems arise, frequently performance related problems, you have two camps: Application developers complain about the DBMS being at fault or the DBAs complain about the application drawing too much resources on the DBMS. The only solution for this is to have application developers with a very thorough

understanding of how a DBMS works and how performance is compromised or can be improved, should the need arise (I tell this my students all the time).

PS:
I think that it depends on the situation.
If you are hiring a junior person (just leaving the university) some kind of DB certification is required. But if you are hiring a senior person with a lot of experience and a few previous jobs a certificate is not so important.

SAK:
It is always good to have some kind of official certification.

LA:
Yes.

EJ:
I think we should.

AR: (translation from Finnish)
Yes, it might show some kind of interest, if you have passed one, but I would not take it as a requirement.

JR: (translation from Finnish)
In this case it is a question of law of supply and demand, meaning that it depends on what kind of band of people you have as applicants. If you are looking for an intelligent expert from the very beginning and there are applicants both with certificate and without, then of course you have better possibilities with a certificate. In practice it will surely take some time before certification can be required.

LH:
No, but maybe some our customer like it that we have db certifications.

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2. Do you find adequate the level of DB knowledge offered by a typical university degree in computer science or informatics?

NA:
Only if the LAB experience is adequate. It depends on the institution and the individual. Generally, universities concentrate on theoretical models, which in the praxis have no meaning. So I would say that typical courses on Dbases are rather inadequate for the needs of the market.'

RN:

I am not expert in this. Anyway, I think that not. DB techniques are teached, maybe even some tool. But only working practice gives the deep knowledge in this topic.

AK:

The level of knowledge and qualification unfortunately varies strongly between universities: in several cases the knowledge and skill qualification found in a graduate from a university department for Applied Informatics is far lower from any viewpoint with respect to the quality of education provided by a Technological Education Institute Department for Informatics. Also, I am afraid, that this quality varies within the same Department from year to year as the academic personnel responsible for teaching the particular course may change.

EM:

The readings/lessons in database technology differ a lot between universities and also within each one. My experience is, that people coming from university, know fundamentals of databases and that they have to learn a lot when they start as DB developer or administrator.

JJ:

Well, based on the problems we see in the field I would say that the DB knowledge level offered is not adequate.

AS:

No I do not.They give high level of theoretical knowledge but very low experience and knowledge in practical issues.

JH:

All I can say is: it depends. Very few people really "get" DBMSs. This is fairly astonishing, since database technology is such a basic technology and one of the very pillars of IT. But this may also be the reason why it is neglected here and there.

On the other hand, the "old farts" (and I use this term just jokingly, and not in the least derogatively) I met, i.e. experienced developers who learned their trade during the times of the mainframe and mostly centralized computing, really know their DBMS inside out. Be it DB2, IMS or whatever.

PS:

I think that the university offers a good information 'ground', so that it is a good starting point. Of course the real world is the best teacher - that is you gain the experience only by practicing your skills in real situations. So maybe in this way university is too theoretical.

SAK:

Basically yes. The most practical things you learn at work.

LA:

What is the level of ... a typical ...? Every one should have reached moderate level but some person's have quite weak knowledge. Best specialists are fine.

EJ:

Depends on individual - hard to find typical. It can be hard to find true professionals right after studies (but again this depends on what kind of background person have)

AR: (translation from Finnish)

I don't know what is a typical degree, so I won't answer.

JR: (translation from Finnish)

It is not enough to confirm that a person would be a competent database designer. Especially you learn by practice but there are also holes in the theoretical basis.

LH:

It is not enough

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3. Do you think that organizations could benefit and reduce the cost of in-house training by employing certified DB professionals?

NA:

Yes, see 1.

RN:

Yes, there is no need that all companies invent their own training packages and programs. Such a standardised way of DB education is really needed. One benefit is that the company knows what is the starting level of new employees.

AK:

Only under the conditions of Question 1 above. But usually there is also the matter of in-house training of the new employees with respect to the existing procedures and processes related with the use of DB - this type of knowledge cannot be contracted out - unless the organisations will be having their own training departments and education units which will be monitoring the overall certification process. This would make sense in case of Greece only for the public sector and for a few far-sighting companies.

EM:

I think that organisations would benefit from well educated professionals, but I don't think they save much money hiring people with certificate. Databases differ a lot in

administration and also in programming. If organisations use databases of one vendor, the people have to be trained on this software.

JJ:
This question is somehow leading. While I agree that the potential to reduce cost is there I do not necessarily see this as the main motivation for DB certification. Ensuring that the work is done better and with less hassle would be a better motivation from my perspective.

AS:
Yes. Not exactly the training cost, because the training must never end, but the operational cost of their DB.

JH:
I am a bit critical of the whole "certified whatever" business. But lets put it the other way around: giving some more emphasis on a thorough DBMS education which goes beyond "and then you click here in SQL Server's administration console..." would most likely not only save money, but would also help to make projects run smoother.

PS:
I'm not sure if I understand the question correct. If the aim is to hire one certified DB professional to train the others it totally depends on the person. Many DB professionals are very poor teachers. They just don't know how to share the information. If the aim is to hire only certified DB professionals so that you don't have to train them any more (because they already know everything) I think it's not from this world. You have to train the employees regularly anyway in this business or you are out of the business.

SAK:
At least some kind of unified level of (minimum) competence could be achieved. Costs could be reduced by less training and more focused training.

LA:
Of course.

EJ:
Yes.

AR: (translation from Finnish)
In some cases it might happen.

JR: (translation from Finnish)
It might decrease in-house training in the beginning if the new DB people have certification. Of course it depends on experience background but especially if you take in beginners (novice).

LH:
Yes.

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4. Most of the Database certification programs are vendor/product specific programs since working with a DBMS demands deep and thorough knowledge of the corresponding platform, the specialized tools and utilities of the specific product. However, do you believe that an organization should have their employees acquire a vendor/product neutral certification program to verify higher-level knowledge of DB concepts?

NA:
Nobody would deny that. The cost though of such programs is quite high and the owner of a company must "see" the benefit of covering the costs of such a course. It can happen that a good employee learns more or less the same things as in the seminars by practicing the specific database. Things would have been better if the courses were less expensive and conducted by TEI or UNI (without loosing the target on practical matters)and not be private IEK or other "Frontistiria"

RN:
Yes, and that is already happening to some extend. The SWEBOK concept includes DB as one topic, and at least iSQI has such a database certificate. It is closely related with architecture roles and competences, and should not be kept too isolated from those topics and certificates.

AK:
This would be either "good to have" or possibly a positive thing if this neutrality would provide knowledge about specific DB matters and how they are treated by several vendors/products.

EM:
I believe, companies (in general) are not interested to train people neutral from DB systems. In manufacturing companies for example, people have to do specialized work on systems and they have to be educated on these systems.
I asked my manager what he things about this? When he hires someone, many personal characteristics are important for him. Technical knowledge and understanding is important, but specialisation is not very important for him, because this can be learned during work. For him, factors like "does this person fit into my department" or "how does she/he represent our company" are very important beside "is she/he interested in technology". - You should know, he manages a presales department and not a DBA department...

JJ:

I definitely think that there is a need for a vendor/product neutral certification to verify higher-level knowledge of DB concepts. While it is important to be able to e.g. do performance tuning using one product, most of the concepts are not vendor specific. I even claim that it would lead to better understanding if the concepts were more clearly separated from vendor specificity. This way a person can more easily adopt a new product, IMHO.

AS:

The DBs that the most organization are working with are specific So I believe that they have to get people that are specialists on specific DBMS, otherwise they are going to get people with only theoretical background.

JH:

Yes, absolutely. And I don't really subscribe to the point of view that the required knowledge is very product specific. The majority of concepts are more or less the same across vendors, at least within the DBMS paradigm (relational, OO, O/R, XML etc.).

PS:

No, I don't think this is necessary. Every db-employee (or at least most of them) have a good basic-level knowledge of DB concepts and I think that is enough.

SAK:

Vendor-independent knowledge and certification would be useful. At implementation level product-specific needs may suffice but higher expertise calls for understanding beyond specific vendor tools.

LA:

Both are needed product neutral and product specialized.

EJ:

I believe vendor independent certification is also needed (has it's place on the market).

AR: (translation from Finnish)

Personally, I would valuate more vendor independent certificate.

JR: (translation from Finnish)

I think that vendor/product independent knowledge/education is very important. In most cases product based viewpoint remains very concise and you easily start to keep features of the product as standards. Especially, when we do work with many products, it is really valuable that you are familiar with wider context instead of one product.

LH:
Yes.

6 A Suggestion about The Certification Framework Specifications

A summarization of the results of WP6 and suggestions about the framework - specifications of a DBTech Pro DB certification is included in this section.

The Internet based survey regarding the current situation for DB certification shows that vendor/product specific programs dominate the market. From all certification programs that are reviewed very few are vendor/product neutral and provide various tests for verification of general knowledge, e.g. Brainbench. In addition to that, the results of the survey that is conducted as part of Work Package 2 indicate that industry is not that concerned about the existing certification schemes, with a slight preference for certification. However, it seems that there is a desire for an independent certification scheme with more than 80% in agreement and less than 3% in disagreement. Moreover, 82% of those who consider certification as "not important", they "somewhat agree" or "strongly agree" with the need of an independent certification. Similar results are drawn from the personal interviews that are obtained from DB related professionals. Specifically, 11 out of 14 state that they are in favour of having certified employees with a vendor/product neutral certification program in order to verify higher-level knowledge of DB concepts. Although the above results cannot be considered as statistically significant, overall, they indicate that there is a need for a vendor/product neutral certification program.

The framework - specifications of a DBTech Pro certification program could be based upon the outcomes of the following Work Packages:
➢ **WP2**: Knowledge Area
➢ **WP3**: Teaching Practices and Laboratories, Tests
➢ **WP4**: Content Planning and Tests

According to the results of **WP2,** four specialization areas are identified, namely:
➢ Data Access Technologies
➢ Database Administration
➢ Database Design
➢ Business Intelligence (OLAP, Data Warehousing, and Data Mining)

Under the **WP4**, an educational/course content outline is compiled for each one of these four specialized areas along with an entry-level course split into two parts (Basic DBTech Pro Knowledge, and Intermediate DBTech Pro Knowledge). This content can be considered as indicative of the database technology knowledge and skills to be assessed

for DB professional adequacy and specialization. The outline of a typical DBTech Pro course content is structured in the form of a three-level hierarchy (for more details, see: Final Report of Work Package 4: Content Planning):

      - Course Module

          - Topic

               - Indicative List of Sub-Topics

Cases, exercises and specifications of laboratories have been developed under **WP3.** Different teaching practices have been analyzed in co-operation with the pedagogic evaluator. Finally, selected modules have been tested in practice at four (4) international DBTech Pro workshops (in Greece, Spain, Germany and Finland). Relevant educational material has been developed, taught, and evaluated. Moreover, these workshops have been developed following the "vendor-independent" concept (for more details, see: Final Report of Work Package 3: Teaching Practices and Laboratories, Tests).

REFERENCES

The survey on available certification programs was conducted with the guidance of the following web sites and articles:

1. A Computer Certification Web Site http://www.gocertify.com/
2. The Certification Magazine http://www.certmag.com/default.asp
3. Ed Tittel, "The Database Certification Landscape"

http://www.informit.com/articles/article.asp?p=99815

Sections 3.4 and APPENDICES include information for each Database related certification program that was obtained by the corresponding sites.

APPENDICES

Appendix A	Database related certification programs investigated for this report
Appendix A1	The list of core and elective courses that BRAINBENCH program offers for the Database Administrator job role.
Appendix A2	The objectives/skills measured on various tests for IBM certified Database Administrators.
Appendix A3	Outline for the vendor – neutral course "Relational Databases: Design, Tools and Techniques" that is offered by LEARNING TREE INTERNATIONAL.
Appendix A4	The exam contents of MySQL certifications.
Appendix A5	List of ORACLE courses that are offered as part of the certification process.
Appendix A6	The exam preparation guide of TERADATA certifications

APPENDIX A

Database related certification programs investigated for this report

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ADAPTEC, Inc.
http://www.adaptec.com/worldwide/common/index.html?prodkey=acsp_index

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Adaptec, Inc. offers a vendor – specific certification for individuals who wish to validate their expertise in storage technologies using Adaptec's RAID or DuraStor products.
Adaptec Certified Storage Professional (ACSP)
Requirements:
- Pass a single exam (ACSP exam).

BRAINBENCH
http://www.brainbench.com/xml/bb/homepage.xml

Brainbench provides online assessment and certification of over 450 different "**skills"** for individuals and businesses. The SkillsBench measurement system measures and improves business-critical skills across an enterprise and critical employee skills. Brainbench has developed a list of "**Job Roles"** based on the O*NET classification system of the U.S. Department of Labor and Brainbench subject matter experts. Each Brainbench "Job Role" includes a selection of core skills, as well as "elective" skills that employees can choose from based on their specific needs.

The **Database Administrator** "job role" provides a database certification suitable for someone who wishes to enter the database field, acquiring the basic and general applicable knowledge, since the relevance to specific platforms is limited.

In particular, the **Database Administrator "job role"** includes the selection of 6 skills.
Requirements:
There are four vendor independent skills referring to:
- Data Modeling Concepts
- RDBMS Concepts
- SQL (ANSI)
- One elective from the following:
  Data Warehousing, Networking and Programming Concepts.

There are two electives that must be chosen from a list of many vendor specific products. For more details, see Appendix A.

CRYSTAL DECISIONS

http://www.businessobjects.com/services/elearning/default.asp

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Crystal Decisions provides several courses for Crystal Reports®, Crystal Enterprise™, Crystal Analysis® and Crystal Info™ to help an individual master advanced reporting skills. The certification that is offered is suitable for those who work with Crystal reports.

Authorized Crystal Engineer (ACE)

Requirements:

- Must complete online course and pass online exam.

CIW

http://www.ciwcertified.com/

ProsoftTraining offers a vendor independent certification for individuals who work with Internet/Web technologies. CIW provides various series of exams corresponding to specific **"job roles"** such as application developer, e-commerce designer, enterprise developer, internet working professional, security professional, server administrator and site designer.

Certified Internet Webmaster (CIW) Professional

Requirements:

- Hold CIW Associate certification
- Pass any CIW job role series exam

FIELD CERTIFIED PROFESSIONAL ASSOCIATION

http://www.fieldcertification.org/

Field Certified Professional Association(FCPA) offers vendor independent certifications for individuals who wish to demonstrate skills as database administrators or database developers. All exams are vendor independent, although some will represent specialty in a particular vendor's products. These certifications are obtained by following one of three tracks: Microsoft, Oracle, or Sybase.

1. **Field Certified Database Administrator (FCDBA)**
2. **Field Certified Database Developer (FCDBD)**

HP CERTIFIED PROFESSIONAL CERTIFICATION PROGRAM
http://h10017.www1.hp.com/certification/index.html

The HP Certified Professional program is a world-class certification program benchmarked around the world to ensure validation of the technical and sales competencies and expertise needed to plan, deploy, support and service HP technology and solutions.

The HP Certified Professional program is structured with four **certification focus areas**: sales, pre-sales, integration and operating systems. Under each certification focus area, there are increasing levels of achievement that candidates may pursue in the technology of their choice.

HP integration certifications are designed to provide a demonstration of IT professional skills in the planning, implementation and support of HP solutions. There are two levels of certification, namely, the **Accredited Systems Engineer (ASE)** and the **Master Accredited Systems Engineer (MASE).**
Master Accredited Systems Engineer (MASE-ASE)

This level of certification measures the competencies required for hands-on design as well as the skills needed for the integration and support of business solutions for complex, enterprise environments. Given a set of customer business requirements this individual is expected to be able to design, support and integrate application, middleware, platform, operating system, storage, network and option components necessary to solve business needs. The ideal candidate is anyone who deploys complex solutions based on HP technologies. Individuals pursuing this level must meet the prerequisite of having the Accredited Systems Engineer certification.

The **Master Accredited Systems Engineer Certifications** related to **Database field** are:
- Oracle on Tru64 UNIX
- Oracle on Windows
- SQL Server

1) Master Accredited Systems Engineer - Oracle on Tru64 UNIX
Prerequisites:
- HP AlphaServer Systems Tru64 UNIX certification and any one of the following certifications or sets of exams is required:
- Oracle8 Database Operator (DBO) exam
- Oracle Internet Database Operator (iDBO) exam
- (subset of the Oracle8i DBA certification)
  Oracle8i: Architecture and Administration exam

and
Oracle8i: Backup and Recovery exam
- (subset of the Oracle8 DBA certification)
Oracle8: Database Administration exam
and
Oracle8: Backup and Recovery exam

Requirements
- Oracle8i Integration and Performance with Tru64 UNIX exam

2) Master Accredited Systems Engineer - Oracle on Windows
Prerequisites:
- HP ProLiant Servers- Windows certification
  and any one of the following certifications or sets of exams is required:
- Oracle8: Database Operator (DBO)
- Oracle Internet Database Operator (iDBO)
- (subset of the Oracle8i DBA certification)
  Oracle8i: Architecture and Administration exam
  and
   Oracle8i: Backup and Recovery exam
- (subset of the Oracle8i DBA certification)
  Oracle8i: Database Administration exam
  and
  Oracle8i: Backup and Recovery exam
- Oracle9i Database Administrator Certified Professional

Requirements:
- Integrating Oracle9i with HP Platforms - Windows Exam

3) Master Accredited Systems Engineer - SQL Server
Prerequisites:
- HP ProLiant Servers- Windows
- Microsoft MCDBA Certification

Requirements:
- HP/Microsoft SQL Server 2000 Integration and Performance exam

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IBM PROFESSIONAL CERTIFICATION PROGRAM
http://www-1.ibm.com/certify/index2.shtml

IBM Professional Certification validates the skills of IT professionals and demonstrates their proficiency in the latest IBM technology and solutions. IBM offers a variety of certifications organized by the level of difficulty (Entry, Intermediate, and Advanced), the

"role title" and the corresponding product. Some of the "role titles" related to Database field are presented below (the list is not inclusive):

Entry Level
IBM Certified Database Associate
Intermediate Level
IBM Certified Database Administrator

Advanced Level
IBM Certified Advanced Database Administrator

The corresponding products to all "role titles" are presented on the following table:

Software	Hardware
CICS	AIX and IBM ©**server**pSeries
e-business	IBM©**server**Series
IBM DB2 Information	IBM©**server**xSeries
Management	IBM TotalStorage
IBM WebSphere	
IBM WebSphere Business	
Integration	
Lotus	**Other**
Tivoli Software	Grid Computing
XML	Life Sciences
	Retail Store Solutions

Table 9. Role Titles

1) IBM Certified Database Associate DB2 Universal Database V8.1 Family

This Database Associate is an entry level DBA or a user of any of the DB2 family of products. This individual is knowledgeable about the fundamental concepts of DB2 Universal Database V8 through either hands on experience or formal and informal education. The database associate should have an in-depth knowledge of the basic to intermediate tasks required in day-to-day administration, basic SQL (Structured Query Language), understand how DB2 Universal Database V8.1 is packaged and installed, understand how to create databases and database objects, and have a basic knowledge of database security and transaction isolation.

Recommended Prerequisite

- Entry level experience as a DB2 Universal Database V8.1 Database Administrator

Requirement

- One test: Exam 700, DB2 UDB V8.1 Family Fundamentals.

2) IBM Certified Database Administrator DB2 UDB V8.1 for Linux, UNIX and Windows

This certification role is appropriate for individuals who are knowledgeable with DB2 Universal Database V8.1 and are capable of performing the intermediate to advanced skills required in the day-to-day administration of DB2 instances and databases.

Recommended Prerequisite

- Significant experience as a DB2 Universal Database V8.1 Database Administrator

Requirements

- Two tests : (Exam 700 or 512) and (Exam 701)

or

- One test (Exam 706) and be certified as an IBM Certified Solutions Expert - DB2 Universal Database V7.1 Database Administration for UNIX, Windows and OS/2

3) IBM Certified Advanced Database Administrator DB2 Universal Database V8.1 for Linux, UNIX, and Windows

An IBM Certified Advanced Database Administrator is the lead DBA for the DB2 products on one or more of the following platforms: Linux, UNIX (including AIX, HP-UX, and Sun Solaris), and Windows. This individual has extensive experience as a DBA and extensive knowledge of DB2 Universal Database. This person is capable of performing the advanced tasks such as performance, high availability, and networking that are required.

Recommended Prerequisite

- Significant experience as a senior Database Administrator on DB2 Universal Database for Linux, UNIX, or Windows.

Requirements

- Three tests: (Exam 700 or 512) and (Exam 701) and (Exam 704)
- One test (Exam 704) and be certified as an IBM Certified Database Administrator DB2 UDB V8.1 for Linux, UNIX and Windows

For more details on the description of the referred exams, see Appendix B.
Some more "role titles" related to Database field are presented below
(the list is not inclusive):

Entry Level
4) IBM Certified Specialist -or- IBM eServer Certified Specialist

Intermediate Level
5) IBM Certified Solutions Expert -or- IBM eServer Certified Solutions Expert

Advanced Level
6) IBM Certified Advanced Technical Expert

For more information on these roles and their corresponding description and requirements
you may visit the official IBM web site: http://www-1.ibm.com/certify/index2.shtml

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LEARNING TREE INTERNATIONAL
http://www.learningtree.com/us/cert/index.htm

Learning Tree International is involved in hands-on training for Management and
Technology Profes sionals. Since 1974, over 1,400,000 individuals from over 13,000
organizations around the world have participated in corresponding programs in order to
enhance their professional skills. Learning Tree is vendor independent although some of
its certifications are vendor dependent. Learning Tree training method aiming at "learn by
doing", provides brief lectures and hands-on exercises under the guidance of expert
instructors.

Learning Tree offers 45 Job-Specific Professional Certification Programs that validate
technical expertise and professional skills. Each program requires the successful
completion of three core courses, and one elective course.

The Certification Areas that are related to Database field are the following:
- SQL Server
- Oracle9i/8i
- Access

In particular, the various certification programs of each certification area that are offered
along with the corresponding courses are presented below. In general, the set of elective
courses is different for each certification and is focused on vendor dependent products.
However, the course "Relational Databases: Design, Tools and Techniques" is vendor

independent and is recommended in most certifications. The outline of this course is included in Appendix C.

1) SQL Server 2000 DBA Certified Professional
- Windows 2000 or Windows Server 2003
- SQL Server 2000 Comprehensive Introduction: Hands-On
- SQL Server 2000 Database Administration: Hands-On
- Plus 1 of 10 Elective Courses

2) SQL Server Application Development Certified Professional
- SQL Server Transact-SQL Programming
- SQL Queries for SQL Server
- High-Performance SQL Server Databases
- Plus 1 of 7 Elective Courses

3) Oracle9i DBA Certified Professional
- Oracle9i Introduction
- Oracle9i Database Administration
- Oracle Databases: Backup, Recovery & Tuning
- Plus 1 of 5 Elective Courses

4) Oracle9i Application Development Certified Professional
- Oracle9*i* Introduction
- Oracle PL/SQL Programming
- Oracle Databases: Application Dev & Tuning
- Plus 1 of 6 Elective Courses

5) Oracle8i DBA Certified Professional
- Oracle8*i* Introduction
- Oracle8*i* Database Administration
- Oracle Databases: Backup, Recovery & Tuning
- Plus 1 of 4 Elective Courses

6) Oracle8i Application Development Certified Professional
- Oracle8*i* Introduction
- Oracle PL/SQL Programming
- Oracle Databases: Application Dev & Tuning
- Plus 1 of 6 Elective Courses

7) Access Certified Professional
- Access Introduction
- Programming Microsoft Access
- Microsoft Access for Enterprise Applications
- Plus 1 of 9 Elective Courses

MICROSOFT
http://www.microsoft.com/learning/mcp/default.asp

Microsoft provides two of the most popular certifications:
- Microsoft Certified Database Administrator (MCDBA)
- Microsoft Certified Solution Developer (MCSD)

1) Microsoft Certified Database Administrator (MCDBA) on Microsoft SQL Server™ 2000 candidates need to pass three core exams and one elective.

Requirements
- One SQL Server administration exam
- One SQL Server design exam.
- Windows 2000 Server or Windows Server 2003 exam
- One elective exam that provides proof of expertise with a specific Microsoft server product.

2) Microsoft Certified Solution Developer (MCSD) for Microsoft .NET candidates need to pass four core exams and one elective.

Prerequisite
- Two years of experience developing and maintaining solutions and applications

Requirements
- Web application development
- Windows application development
- XML Web services and server components development
- Solution architecture
- One elective exam that provides proof of expertise with a specific Microsoft server product

> **MySQL**
> http://www.mysql.com/certification/index.html

MySQL AB has announced the release of both the exams that make up the central part of its Certification Program:

- MySQL Core Certification
- MySQL Professional Certification (which is now available as a Beta try-out)

The MySQL Core Certification is aimed at the professional MySQL user who wants proof of his or her prowess in the fields of SQL, data entry and maintenance, data extraction for reporting, etc. This certification was released on March 5, 2003.

The certification is obtained by passing an exam. All MySQL exams are delivered through a world-wide network of 3.000 Pearson VUE testing centers.

The MySQL Professional Certification is for the user who has more experience in the world of MySQL, and wants the credentials that prove his or her knowledge in such areas as database management, installation, security, disaster prevention and optimization. This certification was released in Beta on April 11, 2003.

1) MySQL 4 Core Certification

The Core Certification validates the capability of creating and using databases and tables, inserting, modifying, deleting and retrieving data from a MySQL database, all based on a number of criteria like those that occur in real-world situations.

Requirements

- Passing a single exam.

2) MySQL 4 Professional Certification

The MySQL Professional validates the capability installing a server from scratch, keeping the server running smoothly at all times, using the new table types, using more advanced SQL, and analysing the trouble spots of other users' queries.

Prerequisite

- MySQL Core Certification

Requirements

- Passing a single exam

The contents of the above exams are included in Appendix D.

> **ORACLE**
> http://www.oracle.com/education/certification/

Oracle Certification validates the level of knowledge, skill and experience on the job as an Oracle Professional.

ORACLE provides three certifications (listed below) for the specific "job role" of the Database Administrator. Each exam is designed to act as a valid representation of the most important skills and job tasks for a Database Administrator.

Database Administrator
- Oracle8i Certified Professional
- Oracle9i Upgrade from DBA OCP
- Oracle9i Certified Associate, Professional and Master

1) Oracle8i Certified Professional

Requirements:
Passing the following five exams
- Introduction to Oracle: SQL and PL/SQL
  or
  Introduction to Oracle9i: SQL
- Oracle8i: Architecture and Administration
- Oracle8i: Backup and Recovery
- Oracle8i: Performance Tuning
- Oracle8i: Network Administration

2) Oracle9i Database Administrator Certified Associate

Requirements:
To earn the Oracle9i Database Administrator Certified Associate credential, two exams are required;
- Introduction to Oracle9i: SQL
  This is an online exam. It is also available at Oracle University or Authorized Prometric Test Centers.
  or
  Introduction to Oracle: SQL and PL/SQL
- Oracle 9i Database: Fundamentals I
  This is a proctored exam that is only available at Oracle University or Authorized Prometric Test Centers

3) Oracle9i Database Administrator Certified Professional

Requirements:
Holding Oracle9i DBA Certified Associate (OCA) credential and passing the following two exams as well as completing at least one Oracle University hands-on course (these courses are listed in Appendix E.):
* Oracle9i Database: Fundamentals II
* Oracle9i Database: Performance Tuning

4) Oracle9i Database Administrator Certified Master

Prerequisites:
* Holding Oracle9i Database Administrator Certified Professional
Requirements:
* Pass the Oracle9i DBA Certified Master practicum.

ORACLE also provides the following certifications for the specific "job role" of Application Developer:

5) Oracle Forms 6i Developer Certified Professional

6) Oracle9i PL/SQL Developer Certified Associate and Forms Developer Certified Professional

7) Oracle9i Forms Developer OCP Upgrade Path

For more information on these certifications you may visit the official ORACLE web site:
http://www.oracle.com/education/certification/

PERVASIVE
http://www.pervasive.com/training/certification.asp

Pervasive Software provides vendor – specific certifications for individuals who wish to validate their skills in working with Pervasive products such as installing, configuring, and troubleshooting Pervasive database products or designing and coding Pervasive SQL applications.

1) Certified Pervasive Developer

Requirements:
* Pass a single (CPD) exam

2) Certified Pervasive Technician

Requirements:
- Pass a single online exam

SYBASE
http://www.sybase.com/education/profcert

Sybase offers professional certifications to validate the technical skills, experience, and confidence required to design and implement real-world solutions. IT professionals can be qualified Sybase database professionals and developers. The available certifications are the following:

1) Adaptive Server Administrator Associate/Professional
2) Replication Server Administrator
3) EAServer Developer Associate
4) Enterprise Portal Developer
5) PowerBuilder Developer Associate/Professional
6) SQL Developer Associate

Requirements (for each certification):
- Passing a single exam (usually a multiple choice exam)

TERADATA
http://global.ncreducation.com/teradata/certlevels.htm

Teradata Customer Education supports six certifications that can help you validate your expertise. Three Baseline Certifications and three Job Role Certifications demonstrate baseline concept proficiency and extend into job functionality critical to the operation of a Teradata database.

Certification levels
Baseline Certifications:
- Teradata Certified Professional
- Teradata Certified Implementation Specialist
- Teradata Certified SQL Specialist
- Job Role Certifications:
- Teradata Certified Administrator
- Teradata Certified Designer

- Teradata Certified Application Developer

Baseline Certifications are designed as prerequisite exams to prepare you for Certified Job Roles.

1) Teradata Certified Professionals have proven their expertise in core concepts of Teradata products. They understand the major architectural features of the product, have a basic knowledge of elementary SQL functions and have a strong understanding of relational databases.

- Exam NR-001: Teradata Basics

2) Teradata Certified Implementation Specialists are qualified to implement and maintain a Teradata database. They thoroughly understand how Teradata handles data distribution and access. They can also take full advantage of the robust features of Teradata's intelligent optimizer.

- Exam NR-001: Teradata Basics
- Exam NR-002: Teradata Physical Implementation

3) Teradata Certified SQL Specialists are qualified to retrieve and manipulate data with Teradata Structured Query Language (SQL) using both ANSI standard conventions and Teradata extensions to the language.

- Exam NR-001: Teradata Basics
- Exam NR-003: Teradata SQL

The Teradata Certified Job Role Tracks are the premier certifications within NCR. They demonstrate not only baseline concept proficiency but extend into job functionality critical to the operation of a Teradata database.

4) Teradata Certified Administrators have proven their ability to implement, tune, and maintain a Teradata database for a production environment. Candidates have a thorough understanding of capacity planning, workload optimization, security, backup/recovery, and release management.

- Exam NR-001: Teradata Basics
- Exam NR-002: Teradata Physical Implementation
- Exam NR-004: Teradata Administration

5) Teradata Certified Designers are qualified to design an overall architecture centered around the Teradata database. This includes application optimization and data protection strategies.

- Exam NR-001: Teradata Basics
- Exam NR-002: Teradata Physical Implementation
- Exam NR-005: Teradata Design.

6) Teradata Certified Application Developers are qualified to write applications that are optimized for, and take advantage of Teradata. This encompasses the leverage of parallelism and inherent data manipulation techniques unique to Teradata. Other skills and knowledge include making the best choices and use of available Teradata Application Utilities, ensuring smooth implementations and producing a quality end-to-end solution.

- Exam NR-001: Teradata Basics
- Exam NR-003: Teradata SQL
- Exam NR-006: Teradata Application Development

The exam preparation guide is included in Appendix F.

U2TEST
http://www.u2test.com/

U2test offers several certifications through various general and platform exams. Some of the available exams are listed below (the list is not inclusive):
CRM CONCEPT
E-BANKING CONCEPT
ECOMMERCE CONCEPT
EMERGING TECHNOLOGIES
ERP CONCEPT
INFORMATION SYSTEM MANAGEMENT
LOTUS NOTES DOMINO R-5
MIS CONCEPT
ORACLE 8 PL/SQL
ORACLE 8 (DBA)
SQL SERVER 7

APPENDIX A1

BRAINBENCH
Database Administrator
Responsible for the overseeing the physical design and management of the database and for evaluating, selecting, implementing, and monitoring a database management system.

Required (Select 3)
Data Modeling Concepts
RDBMS Concepts
SQL (ANSI)

Elective 1 (Select 1)
Data Warehousing Concepts
Networking Concepts
Programming Concepts

Elective 2 (Select 1)
Adabas Administration
DB2 Administration (OS390)
DB2 Administration (UDB)
Informix 7.X Administration
MS SQL Server 2000 Administration
MS SQL Server 6.5 Administration
MS SQL Server 7 Administration
MySQL 3.23 Administration
Oracle 8.0 Administration
Oracle 8i Administration
Oracle 9i Administration
Sybase 11.X Administration

Elective 3 (Select 1)
MS Access 2000 Programming
MS Access 97 Programming
MS SQL Server 2000 Programming
MS SQL Server 6.5 Programming
MS SQL Server 7 Programming
Oracle PL/SQL

APPENDIX A2

DB2 UDB V8.1 Family Fundamentals
Test 700 Objectives/Skills Measured on Test

This exam contains a total of 54 questions. Candidates are required to score 61% or better to pass the exam and will have 75 minutes to complete the exam.

Section 1 - Planning (15%)
- Knowledge of DB2 UDB products (client, server, etc.)
- Knowledge of the features in DB2 tools such as: DB2 Extenders, Configuration Assistant, Visual Explain, Command Center, Control Center, Relational Connect, Replication Center, Development Center, and Health Center
- Knowledge of Datawarehouse and OLAP concepts
- Knowledge of non-relational data concepts (extenders, etc)

Section 2 - Security (9%)
- Knowledge of restricting data access
- Knowledge of different privileges
- Accessing DB2 UDB Data 15%
- Ability to identify and locate DB2 UDB servers
- Ability to access and manipulate DB2 UDB objects
- Ability to create basic DB2 UDB objects

Working with DB2 UDB Data 31%
- Knowledge of transactions
- Given a DDL SQL statement, knowledge to identify results
- Given a DML SQL statement, knowledge to identify results
- Given a DCL SQL statement, knowledge to identify results
- Ability to use SQL to SELECT data from tables
- Ability to use SQL to SORT or GROUP data
- Ability to use SQL to UPDATE, DELETE, or INSERT data
- Ability to call a procedure

Working with DB2 UDB Objects 19%
- Ability to demonstrate usage of DB2 UDB data types
- Given a situation, ability to create table
- Knowledge to identify when referential integrity should be used
- Knowledge to identify methods of data constraint
- Knowledge to identify characteristics of a table, view or index

Data Concurrency 11%
- Knowledge to identify factors that influence locking
- Ability to list objects on which locks can be obtained
- Knowledge to identify characteristics of DB2 UDB locks
- Given a situation, knowledge to identify the isolation levels that should be used

**DB2 UDB V8.1 for Linux, UNIX, and Windows Database Administration
Test 701 Objectives/Skills Measured on Test**

This exam contains a total of 70 questions. Candidates are required to score 61% or better to pass the exam and will have 90 minutes to complete the exam.

Section 1 - DB2 Server Management (19%)
- Ability to configure/manage DB2 instances (e.g. scope)
- Knowledge of DB2 authentication
- Knowledge of DB2 authorizations
- Ability to set user and/or group privileges
- Knowledge of the DB2 force command
- Ability to configure client/server connectivity
- Ability to schedule jobs
- Ability to configure client server connectivity using DISCOVERY
- Skill in interpreting the Notify log

Section 2 - Data Placement (17%)
- Ability to create a database
- Skill in discussing the use of schemas
- Skill in discussing the various table space states
- Ability to create and manipulate the various DB2 objects
- Ability to create and discuss the characteristics of an SMS tablespace
- Ability to create and discuss the characteristics of a DMS tablespace

Section 3 - Database Access (17%)
- Ability to create DB2 Tasks using the GUI tools
- Knowledge of the creation and management of indexes
- Ability to create constraints on tables (e.g., RI, Informational, Unique)
- Ability to create views on tables
- Skill in examining the contents of the System Catalog tables
- Ability to use GUI Tools to access DB objects
- Knowledge of how to enforce data uniqueness

Section 4 - Monitoring DB2 Activity (16%)
- Ability to obtain/modify database manager configuration information
- Ability to obtain/modify database configuration information
- Ability to capture EXPLAIN/VISUAL EXPLAIN information
- Skill in analyzing EXPLAIN/VISUAL EXPLAIN information (sortheap, buffpage, degree)
- Ability to identify the functions of the DB2 Governor and Query Patroller
- Ability to obtain and modify DB2 registry variables
- Ability to capture snapshots
- Ability to create and activate event monitors
- Ability to Identify output from the Health Center

Section 5 - DB2 Utilities (17%)
- Ability to use EXPORT utility to extract data from a table
- Ability to use IMPORT utility to insert data into a table
- Ability to use the LOAD utility to insert data into a table
- Knowledge to identify when to use IMPORT vs. LOAD
- Ability to use the REORG, REORGCHK, REBIND and RUNSTATS utilities
- Ability to use DB2Move and DB2Look
- Knowledge of the functionality of the DB2 Advisors
- Ability to use the DB2 Control Center

Section 6 - Backup and Recovery (14%)
- Ability to perform database-level and table space level BACKUP & RESTORE
- Knowledge to identify and explain issues on index recreation
- Knowledge of database logging
- Knowledge of crash recovery
- Knowledge of version recovery
- Knowledge of Roll Forward recovery

DB2 UDB V8.1 for Linux, UNIX, and Windows Database Administration Upgrade Exam
Test 706 Objectives/Skills Measured on Test

This exam contains a total of 30 questions. Candidates are required to score 55% or better to pass the exam and will have 40 minutes to complete the exam.

Section 1 - DB2 Server Management (20%)
- Configure DB2 using online configuration parameters
- Prepare database for exclusive mode for maintenance
- Use of Notify log for system administration
- Configure DB2 Administration Server

Section 2 - Data Placement (13%)
- Use snapshot monitor to obtain information on table space state
- Maintain the DMS table space by adding, dropping, or changing the size of a container
- Create and manipulate various DB2 objects (buffer pools, new indexing and temporary tables)

Section 3 - Database Access (13%)
- Create and manage indexes to provide better concurrency
- Use informational constraints in table definitions

Section 4 - Monitoring DB2 Activity (14%)
- Use SQL to access snapshot monitor data
- Create and activate event monitors
- Configure and use Health Monitor and Health Center to improve database availability

Section 5 - DB2 Utilities (23%)
- Use the LOAD utility to insert data into a table online
- Use the REORG, REORGCHK, REBIND and RUNSTATS utilities
- Knowledge of the functionality of the DB2 Advisors
- Use the DB2 Control Center
- Use the inspect utility to determine problems with database

Section 6 - Backup and Recovery (17%)
- Configure system for new logging features
- Use the roll forward recovery to different points of time
- Use incremental backups to enhance recovery duration
- Use DB2 suspend I/O and resume I/O capabilities to enhance recovery and high availability

DB2 UDB V8.1 for Linux, UNIX and Windows Advanced Database Administration Test 704 Objectives/Skills Measured on Test

This exam contains a total of 57 questions. Candidates are required to score 56% or better to pass the exam and will have 75 minutes to complete the exam.

Section 1 - Advanced Administration (32%)
- Ability to design table spaces
- Ability to create table spaces
- Ability to manage table spaces
- Ability to design buffer pools
- Ability to create buffer pools
- Ability to manage buffer pools
- Ability to exploit intra-parallelism

- Ability to exploit inter- parallelism
- Ability to design and configure federated database access
- Ability to manage distributed unit of work

Section 2 - High Availability (19%)
- Ability to develop a logging strategy
- Ability to use advanced backup features
- Ability to use advanced recovery features
- Ability to implement a standby database (log shipping, replication, failover, fault monitor)

Section 3 - Performance and Scalability (37%)
- Identify and use configuration parameters that affect database system performance
- Identify and use DB2 registry variables that affect database system performance
- Knowledge of query optimizer concepts
- Ability to manage and tune memory and I/O
- Ability to analyze performance problems
- Ability to manage a large number of users and connections
- Ability to partition large amounts of data for performance
- Ability to manage the number of partitions in a database
- Ability to create and manage multi-dimensional clustered tables
- Ability to determine the more appropriate index

Section 4 - Networking & Security (12%)
- Ability to configure a partitioned database on multiple servers
- Ability to manage connections to host systems
- Ability to identify and resolve connection problems
- Knowledge of external authentication mechanisms
- Ability to implement data encryption

APPENDIX A3

LEARNING TREE INTERNATIONAL
Relational Databases: Design, Tools and Techniques

INTRODUCTION
An overview of DBMS technology
- Key concepts and terminology
- How data is accessed, organized & stored
- The importance of business rules
- Uses of databases: production and decision-support
- The database development process

Three-level information architecture
- External schema: a user's view of data
- Conceptual schema: logical data model
- Internal schema: physical data structures

DB server/user toolkit architecture
- Query languages
- Report writers
- Query and application development tools
- Data-modeling CASE tools

HOW A RELATIONAL DBMS WORKS
Relational technology fundamentals
- The structure of a relational database
- Tables, attributes and relationships
- Primary and foreign keys
- Relational integrity constraints
- Semantic integrity, existence constraints
- Manipulating data: selection, projection, join, union, intersection, difference

Components of a relational DBMS
- An integrated, active data dictionary
- The query optimizer
- An engine that supports transactions, concurrency and recovery
- Front-end tools for easy user access

DESIGNING RELATIONAL DATABASES
- A step-by-step approach and techniques
- Developing the logical data model
- Mapping the data model to the relational model
- Specifying integrity constraints

- Developing the conceptual schema
- Defining the data in the data dictionary

Entity-relationship modeling
- Capturing entities, attributes & identifiers
- Describing relationships: one-to-one, one-to-many, many-to-many
- Optional and mandatory relationships
- Guidelines for a well-formed E-R diagram
- Resolving many-to-many relationships for implementation in an RDB

Using a CASE tool
- Database design and documentation
- Generating the SQL to build the database
- Reverse engineering to capture the design of an existing database

Designing normalized databases
- Why/why not normalize
- Using functional dependencies
- Using Codd's rule
- Denormalization impact and alternatives

Physical database design
- Grouping and assigning tables to disk files for performance and maintenance
- Indexing for performance and integrity
- Table fragmentation & denormalization

ACCESSING A RELATIONAL DATABASE SQL
- A dynamic and evolving language
- ANSI and ISO standards

Creating a relational database
- Defining the database and its objects: tables, keys, views and indexes
- Declaring integrity constraints
- Altering structures and constraints

Manipulating and controlling a database
- Querying the database to retrieve exactly the desired information
- Updating data while maintaining database integrity
- Controlling access to data for security

Creating and using views
- Defining views for simplicity and security
- Customizing windows into the database
- Querying and updating through views

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DATABASE DIRECTIONS
Extended capabilities of the RDBMS
- Encapsulating function and data
- User-defined datatypes and methods

Enforcing business rules for data integrity
- Defining declarative constraints
- Server-side programming in Java or a procedural language

TRENDS
- Modeling in analysis and design
- Focusing on business rules
- Creating an intelligent server
- Using stored procedures and triggers

APPENDIX A4

Exam contents - MySQL Core Certification
MySQL and MySQL AB - 10%
- The difference between MySQL and MySQL AB
- How MySQL AB operates
- MySQL core values
- MySQL dual licensing
- Organisation and structure of the MySQL reference manual
- The MySQL mailing lists

MySQL Software - 10%
- Major program components used in MySQL
- Major operating system families supported by MySQL
- Differences between major MySQL distributions
- Available MySQL client interfaces

Using MySQL Client Programs - 10%
- Invoking command-line client programs
- Specifying command-line options
- The mysql client
  - Using mysql interactively
  - Using script files with mysql
  - mysql client commands and SQL statements
  - Using the --safe-updates option
- Using mysqlimport
- Using mysqldump and reloading the dump
- Checking tables with mysqlcheck and myisamchk
- Using MySQLCC
- Using MySQL Connector/ODBC and MySQL Connector/J

Data Definition Language - 20%
- General database and table properties
- Storage engines and table types
- Limits on number and size of database components
- Identifier syntax
- CREATE DATABASE, DROP DATABASE
- CREATE TABLE, ALTER TABLE, DROP TABLE
- CREATE INDEX, DROP INDEX; specifying indexes at table-creation time
- Creating and using primary keys
- Column types
- Using AUTO_INCREMENT

- String and number formats
- Using SHOW and DESCRIBE to review table structures

SELECT Statements - 10%
- Selecting which columns to display
- Restricting a selection using WHERE
- Using ORDER BY to sort query results
- Limiting a selection using LIMIT
- Aggregate functions, GROUP BY, and HAVING
- Using DISTINCT to eliminate duplicates
- Concatentating SELECT results with UNION

Basic SQL - 10%
- Using SQL expressions and functions
- Using LIKE for pattern matching
- Using IN() to test membership
- Case sensitivity in string comparisons
- Case sensitivity in database, table, column and function names
- Using reserved words as identifiers
- NULL values in SELECT statements
- Comments in SQL statements

Update Statements - 10%
- INSERT and REPLACE
- UPDATE
- DELETE and TRUNCATE
- Handling duplicate key values
- Using ORDER BY and LIMIT with UPDATE and DELETE statements

Joins - 15%
- Writing inner joins using INNER JOIN and the comma (',') operator
- Writing outer joins using LEFT JOIN and RIGHT JOIN
- Converting subqueries to inner and outer joins
- Resolving name clashes using qualifiers and aliases
- Multiple-table UPDATE and DELETE statements

Importing and Exporting Data - 5%
- LOAD DATA INFILE
- Using files on the server and the client host
- Limiting the columns and rows being imported
- SELECT INTO OUTFILE
- Privileges needed for LOAD DATA INFILE and SELECT INTO OUTFILE

Exam contents - MySQL Professional Certification
MySQL Architecture - 15%
- Client-Server Overview
- Choosing the Right Client
- Connecting the Client to the server
- Hard Disk Footprint
- Memory Footprint
- Log and Status Files
- Table Types in MySQL

MySQL Installation and Configuration - 20%
- Installing MySQL on Unix
- Startup and Shutdown on Unix
- Installing MySQL on Windows
- Startup and Shutdown on Unix/Windows
- Configuring MySQL
- Compiling MySQL
- Upgrading MySQL
- Optimising the Operating System for MySQL Use
- Configuring Disks for MySQL Use
- Choosing Hardware for MySQL Use

Security Issues - 15%
- Securing MySQL
- User Account Management
- Client Access Control

Optimising for Query Speed - 15%
- Index Optimisation and Index Usage
- Using Indexes and EXPLAIN to Analyze Queries
- General Query Enhancement
- Optimising the Logical Database Structure

MyISAM Tables - 10%
- MyISAM Specific Optimisation
- Locking Strategies
- Backup and recovery
- Checking and repairing tables
- Table Maintenance

InnoDB Tables - 10%

- Special InnoDB features (ACID compliance, transaction model, versioning, concurrency and isolation levels).
- InnoDB Specific Optimisation
- Locking Strategies
- Backup and recovery
- Checking and repairing tables
- Table Maintenance

Advanced Server Features - 15%

- Interpreting mysqld Server Information
- Measuring Server Load
- Tuning Memory Parameters
- Using the Query Cache
- Using Multiple Servers
- Replication

APPENDIX A5

ORACLE

The courses that fulfill **the hands-on course** requirement for OCP:
- Introduction to Oracle9i: SQL
- Oracle9i Database Fundamentals I
- Oracle9i Database: Fundamentals II
- Oracle9i Database Performance Tuning
- Oracle9i Database New Features for Administrators
  (available to those with Oracle DBA experience on previous releases)
- Introduction to Oracle8i: SQL and PL/SQL

The advanced DBA courses for OCM:
Database Applications
- Advanced PL/SQL
- Oracle9i: Program with PL/SQL
- Oracle9i: Advanced PL/SQL
- Oracle9i: Implement Advanced Queing

Performance Management
- Oracle9i: SQL Tuning Workshop
- Oracle8i: SQL Statement Tuning Workshop
- Oracle9i Database: Advanced Instance Tuning

Advanced Networking and Replication
- Oracle Net Services: Advanced Administration
- Oracle9i Database: Advanced Replication
- Oracle8i Distributed Systems Part 2: Advanced Replication
- Administering the Oracle Internet Directory

Database and Data Management
- Oracle Enterprise Manager 9i
- Managing Oracle on Linux
- Oracle9i Database: Implementing Oracle Streams

Advanced Oracle Security
- Oracle9i Database: Security

High Availability
- Oracle 9i: Data Guard Administration

- Oracle8i: Parallel Server Implementation
- Oracle9i: Real Application Clusters
- Oracle9i Database: Advanced Backup and Recovery using RMAN

Data Warehouse and Large Scale Databases
- Oracle9i: Data Warehouse Administration
- Oracle9i Database: Implement Partitioning

APPENDIX A6

TERADATA
Exam Preparation Guide

Teradata Certification	Exam Name	Courses Recommended*
Teradata Certified Professional	Teradata Basics	Teradata Basics
Teradata Certified Implementation Specialist	Teradata Basics Teradata Physical Implementation	Teradata Basics Teradata SQL Relational Database Modeling Workshop Teradata Physical Implementation
Teradata Certified SQL Specialist	Teradata Basics Teradata SQL	Teradata Basics Teradata SQL
Teradata Certified Administrator	Teradata Basics Teradata Physical Implementation Teradata Administration	Teradata Basics Teradata SQL Relational Database Modeling Workshop Teradata Physical Implementation Teradata Administration Teradata Application Utilities

Teradata Certified Designer	Teradata Basics	Teradata Basics
	Teradata Physical Implementation	Teradata SQL
	Teradata Design	Relational Database Modeling Workshop
		Teradata Physical Implementation
		Teradata Design
Teradata Certified Application Developer	Teradata Basics	Teradata Basics
	Teradata SQL	Teradata SQL
	Teradata Application Development	Teradata Application Development
		Teradata Application Utilities