

TM



EUCIP

European Certification of
Informatics Professionals

EUCIP Database Manager

Elective Level Profile Specification

Version 2.4, February 2007

Short Description

A EUCIP Database Manager is expected to play a key role both in designing data structures and in daily DB administration; therefore, skills requirements include a deep competence in all aspects of database technologies, a teamworking approach to project environments, proficiency in data modelling techniques, but also effectiveness in defining and applying procedures and organising routine operations.

This profile requires a minimum work experience of **36** months in a compatible job role; if this requirement is not fulfilled, the candidate might be certified as an **Associate** Database Manager.

Tasks Overview

The database manager participates in the data analysis activities for the whole information system of the organisation, and defines the major data assets that the business requires. Cooperates with the data analysis function, if deployed, or takes on the responsibility for translating data and procedural requirements into appropriate DBMS resources.

The client side of the design phase is also within the tasks of the database manager, who collects specific user requirements in terms of data usage, and establishes proper rules for client (and client procedure) authorization.

Translates data requirements into detailed conceptual and logical specifications, using advanced modelling techniques, and produces the specific documentation of the data assets mapped into DBMS resources.

Has the capability to choose the DBMS package that best meets the economical and procedural requirements of the organisation, and is capable of deploying it on the hardware resources, even in a distributed environment. Has the responsibility of tracking the system requirements of the DBMS and interacts with system personnel in managing system resources and in emergency events for re-establishing DBMS operation.

Maps the logical structure of the designed data resources into the physical database on the targeted DBMS product. Sets up and runs data collection, transformation and loading operations that populate the databases and provides for routinely integrity checks on the physical resources used in the DBMS.

Defines authorization policies for data access, with specific contribution from business managers within the organisation, and uses appropriate tools to deploy such policies. Takes care of data integrity by designing and carrying out specific backup procedures according to a detailed plan. Prepares emergency plans to handle every type of restart operation and subsequent recovery procedures.

Tracks and monitors the overall DBMS performance, by setting up the collection of specific statistical data on the usage of DBMS resources by deployed applications. Uses the available utilities for analysing data usage, and is capable of setting up, configuring and tuning physical data access structures in order to improve transactions performance.

Participates in data analysis that best suit the business goals, by preparing data marts and reconciling data sources in order to carry out multiple types of data search and discovery plans. Identifies data warehousing techniques to support business intelligence analysis and to provide the organisation with the data structures (extracted from the DBMS) that support such searches. Carries out statistical data analysis and plans data mining operations on the data resources that can be extracted/transformed from the DBMS.

Handles data resources that come in unstructured or in semi-structured format (XML) and applies data transformation routines to turn such resources into a usable set. Whenever applicable, reconciles such data sources into DBMS structures, and carries out any transformation that best prepare such data for data analysis.

Essential Behavioural Skills [2]¹

The Database Manager role requires initiative, flexibility and a rational mental attitude capable of conceptual and analytical thinking, even under stressful conditions.

Organisational sensitivity, analytical and synthetic intelligence, imagination and proactivity are required to formulate and validate solutions.

Attention to detail, a logical-minded and goal-driven approach, flexibility, determination, planning and control aptitude are required to achieve effective results.

Another relevant set of skills is the ability to communicate and interact effectively (in both oral and written form) with colleagues and clients: this shall include a good teamworking approach, efficiency in information acquisition, in as much as the ability to plan, organise, make technical decisions, provide directions and follow-up.

¹ numbers in brackets represent EUCIP points

Detailed Skills Required

Deep competence level [21]

B2.01 Information modelling techniques and tools [1,5]

- Investigate existing systems and define elements of logical data design for required systems.
- Contribute to schema definition for a given business scenario.
- Use both top-down and bottom-up modelling of data.
- Understand the concepts of entity relationship modelling.
- Use entity relationship modelling or class modelling to outline the information requirements of a new business system.
- Use recognised entity modelling techniques to construct a data model reflecting the business needs of the organisation.
- Contribute to data key identification and design.
- Assist in the creation of a Data Catalogue.
- Validate data models from a business processing perspective.
- Specify the requirements for security and integrity of data in a business scenario; requirements should cover integrity, loss of data consistency, logical errors, system errors, hardware failures, human error.

A7.02 Business risk and IT security [1,5]

- Specify the business need for recovery and back-up of data and for protection against viruses.
- Evaluate the need for encryption of data (at rest/in transit) in the light of network “threats” to data integrity.
- Evaluate the risks to the business caused by security threats to IS/IT.
- Contribute to a Security policy for (part of) a business organisation.

B2.02 Designing and implementing databases [2]

- Choose among different types of database architecture (e.g. relational, hierarchical, network, object-oriented) suitable to application requirements.
- Exploit data abstraction: physical level, conceptual level and view level, object-based logical model, record-based logical model and physical data model.
- Apply the principles of object-based logical models: i.e. the entity-relationship model, the object-oriented model.
- Define entities: considerations include entity composition and normalisation.
- Design entity keys: considerations include FOREIGN KEY constraints, PRIMARY KEY constraints, and UNIQUE constraints.
- Design attribute domain integrity: considerations include CHECK constraints, data types, and nullability.
- Know how to use database design tools.
Examples: Oracle Designer, ERWin.
- Implement a physical database.
- Create and alter databases: considerations include file groups, file placement, growth strategy, and space requirements.

- Create and alter database objects: objects include constraints, indexes, stored procedures, tables, triggers, user-defined functions, and views.
- Define object-level security including column-level permissions by using GRANT, REVOKE, and DENY.
- Alter database objects to support replication and partitioned views.
- Troubleshoot failed object creation.

B2.04 Designing and implementing business solutions with transactional support [1,5]

- Analyse architecture requirements. Analyse security requirements.
- Analyse integration requirements. Analyse functional requirements.
- Develop an application made of Business Components.
- Implement Business Rules.
- Handle Exceptions and Errors.
- Create and manage Database Objects.
- Present business data.
- Create custom and dynamic queries.
- Leverage middle-tier validation.
- Handle Business Component Transactions.
- Package Business Services and Data Models.
- Extend and Substitute Business Components.
- Deploy Business Component Applications.
- Create JSP Clients for a Business Components Application.
- Refer to Best Practices.
- Perform system tuning for performance.

B2.03 Working with databases [1,5]

- Use SQL for:
 - o basic select statements
 - o restricting and sorting data
 - o transforming data through single-row functions
 - o displaying data from multiple tables and views
 - o aggregating data using group functions
 - o extracting complex results through subqueries
 - o data manipulation (DML commands)
- Produce readable output through interactive SQL
- Import and export data: methods include the bulk copy.
- Manage result sets by using cursors and SQL: considerations include locking models and appropriate usage.
- Extract data in XML format: considerations include output format and XML schema structure.
- Manage data manipulation by using stored procedures, transactions, triggers, user-defined functions, and views.
- Control data access by using stored procedures, triggers, userdefined functions, and views.
- Define object-level security including column-level permissions by using GRANT, REVOKE, and DENY.
- Know how to use standard Database interfaces like ODBC, JDBC, etc.

B2.07 Database creation and maintenance [1,5]

- Describe the main architectural components of a DBMS.
- Start-up the DBMS server process.
- Manage a DB instance.
- Create a new DB.
- Analyse and maintain Data Dictionary content.
- Analyse and maintain the Control File.
- Analyse and maintain Redo Log /Journaling files.
- Analyse and manage Tablespaces and data files.
- Manage storage structure and relationships.
- Manage Undo Data.
- Manage tables and indexes.
- Know how to assure data integrity.
- Load data into a DB.
- Import and export data: methods include the bulk copy

B2.08 Database administration [1,5]

- Specify data backup / recovery procedures and tools.
- Choose suitable structures for DB instance and media recovery.
- Configure the DB archiving mode.
- Configure and use tools such as the Recovery Manager for:
 - o user-managed backups
 - o Recovery Manager backups
 - o Recovery Manager maintenance
 - o Recovery Catalog creation and maintenance
- Transport data between databases.
- Manage password security and resources.
- Manage roles, users and privileges.
- Configure system features to support multiple languages/character sets.

B2.09 Configuring a database in a network environment [1,5]

- Distinguish homogeneous and heterogeneous Databases.
- Describe:
 - o distributed data storage and networking
 - o basic DBMS net architecture
 - o the role of DBMS net services in client server connections
 - o how web-client connections are established through networking products
- Configure basic net services
 - o server-side
 - o client-side
- Identify how the listener responds to incoming connections.
- Configure and control the listener.
- Configure the listener for IIOP and HTTP connections.
- Describe the difference between host naming and local service name resolution.
- Use Configuration Assistant to configure host naming, local naming method, net service names.
- Perform simple connection troubleshooting.
- Describe a Shared Server architecture.
- Use and configure Shared Server.

- Identify the components of a Shared Server.
- Know how to manage
 - o distributed transactions
 - o deadlock and distributed locking
 - o distributed commit protocol

B2.10 Database performance tuning [1,5]

- Explain the principles of DBMS performance tuning and how to use diagnostic and tuning tools.
- Size the Shared Pool and the Buffer Cache and other DBMS shared structures.
- Monitor and size the redo log buffer and the Java pool.
- Control the amount of Java session memory used by a session.
- Address DB configuration and I/O issues:
 - o describe reasons for partitioning data in tablespaces
 - o diagnose tablespace usage problems
 - o describe how checkpoints work
 - o monitor and tune checkpoints
 - o monitor and tune redo logs
 - o describe the correct usage of extents and blocks
 - o recover space from sparsely populated segments
 - o perform index reorganization
 - o monitor indexes to determine usage
- Optimize sort operations.
- Monitor and detect Lock Contention
- Perform application tuning:
 - o describe the role of the DBA in tuning applications
 - o explain different storage structures, and why one storage structure may be preferred over another
 - o anticipate how different types of indexes will affect performances
 - o identify the optimum DB partitioning method under given circumstances
 - o describe Materialized Views and use Query Rewrites
- Perform SQL statement tuning:
 - o show how an automated Optimizer is used
 - o use stored outlines/statistics
 - o collect statistics on indexes and tables
 - o copy statistics between databases
- Tune the Operating System and the use of resources:
 - o describe different system architectures and the primary steps of OS tuning
 - o identify similarities between OS and DB tuning
 - o assess if virtual memory and paging mechanisms are critical
 - o explain the difference between a process and a thread
 - o set up DB Resource Manager
 - o assign users to Resource Manager groups
 - o create resource plans within groups

B2.06 Data warehousing [2,5]

- Present the value of business information management in increasing the visibility and exploitation of enterprise data.
- Explain the concepts of Data Base (DB), Data Warehouse (DW), data mart and the importance of dedicated systems for analytical purposes.
- Identify relevant sources of data that can feed a Business Intelligence (BI) system, including:
 - o internal and external sources
 - o structured and unstructured data
- Identify and solve inconsistencies in the meaning, scope, and format of data to be used.
- Define a logical model of data for analytical purposes:
 - o categorise data into facts and attributes
 - o identify data relationships and hierarchies
 - o define expressions and metrics
 - o draw standard maps representing the above data model
- Provide guidelines and operational support for data Extraction, Transformation and Loading (ETL).
- Configure a BI tool to host the required logical data model.
- Use a BI tool to design reports (including tables and graphs).
- Perform basic troubleshooting in the usage of a BI tool, identify and solve possible issues in the data model, in the ETL process and in the output functions (reports etc.).

A7.03 Data protection [1,5]

- Evaluate the importance of preventing unauthorized access to business-critical data.
- Analyse issues related to data protection, personal rights regarding privacy and free access to information held by public authorities.
- Explain the principal concepts of the laws in force in the own country and compare them with European recommendations and different jurisdictions.
- Determine which rights, restrictions and obligations apply in a given real case, and what they mean to the organisation.
- Define a robust organisational approach to cope with such regulations and business priorities.
- Analyse risks by probability and severity and identify adequate countermeasures.
- Design procedures for obtaining, using and storing sensitive personal data in compliance with specific requirements, such as
 - o information on why, how and by whom the data are used
 - o right to access personal records and to have them deleted
 - o anonymity and secrecy
- Propose effective ways to train employees about processes, and responsibilities (both organisational and personal).
- Analyse storage solutions and business practices in terms of security and appropriate availability.

B2.11 Data mining [1,5]

- Explain how knowledge can be discovered in DBs.
- Apply various approaches to data analysis:

- multidimensional model
- star schema
- aggregation
- Assess the effectiveness of data mining technologies.
- Evaluate the meaningfulness of
 - association rules
 - classification
 - clustering
- Apply explorative data analysis:
 - univariate analysis
 - bi-variate analysis
 - multi-variate analysis
 - dimensionality reduction
- Use statistical models for data mining.
- Assess data mining models.

B2.12 Semi-structured data and information retrieval [1,5]

- Differentiate among structured, semi-structured and unstructured data.
- Use data structures in XML technology.
- Design XML documents, data and XML schemas
- Align XML documents and DBs:
 - map relational DBs into XML documents
 - store XML documents into relational DBs
 - work with native XML DBs
- Check information retrieval techniques:
 - relevance ranking using terms
 - relevance using hyperlinks
 - synonyms, homonyms and ontologies
 - indexing of documents
- Measure the effectiveness of a retrieval system.
- Exploit the characteristics of web search engines.
- Define the issues in information retrieval from unstructured data.
- Exploit directories and related services.
- Recognize methods for text retrieval on unstructured documents.
- Be aware of word definition techniques using stopwords.
- Understand the use of a thesaurus and manage it.
- Be aware of indexing techniques (as inverted lists) and hints.
- Compare different relevance computation methods.

Incisive competence level [9]

B1.05 Systems design and implementation [1]

- Identify the tasks involved in implementing and designing an IT system.
- Evaluate the business benefits of database technologies, data warehousing and data mining tools.
- Understand the contents of a system specification.
- Understand function specifications.
- Appreciate the need for (and constraints on) Physical Design of Databases (e.g. tables and indexes).
- Perform Forms Design for a business system.
- Contribute to design of screens and dialogues.
- Contribute to recovery and contingency plans.
- Ensure that audit of an Information System is possible.
- Define system controls for an Information System.
- Define the data integrity needs for an IT System.
- Understand Technical System Options and assist the business in evaluation.
- Employ relevant methods of changeover to new systems.
- Contribute to System Review (post implementation).
- Detail the need for design of security, confidentiality and privacy in a system.
- Produce an implementation plan and assist with business implementation and system review.

C7.01 IT service delivery [1]

- Contribute to the creation, via cost-based negotiation, of Service Level Agreements by stating business quality requirements for the specified service.
- Contribute to the organisational Capacity Plan by eliciting predictions of service usage (both existing and planned).
- Contribute to the Business Continuity Plan for an organisation, by specifying threats to and the recovery needs of each service offered by the organisation to its customers.
- Evaluate risk reduction and contingency options prepared by Service Management staff within an organisation.
- Contribute to Continuous Service Improvement plans on behalf of the business.
- Evaluate the various options for Service Desk support suggested by IT Service Management.
- Ensure full support for new services is in place before system implementation is completed.
- Liaise with Service Management staff over the technical impact of requested business changes to existing services.
- Contribute to business impact analysis of all requests for change to a service.
- Assist the business in specifying requests for change to existing services (using ITIL[®] standards or equivalent).

C7.02 Service management essentials [1]

- Establish a proper Service Level Management process and explain its benefits for the organisation.
- Evaluate the main elements of a Service Level Agreement.
- Compare the uses and purposes of Service Level Agreements, underpinning contracts and Operational Level Agreements.
- Negotiate SLA (Service Level Agreement) with internal /external customers and suppliers
- Identify roles/responsibilities in order to control the actual service level against SLA
- Promote initiatives for customers satisfaction and benchmarking
- Set up a proper policy for availability and capacity planning and for IT Service contingency planning.
- Design and assure automatic capture of information for SLA

B1.12 Defining a solution architecture [1]

- Gather and analyse:
 - o user requirements
 - o operational requirements
 - o system requirements for hardware, software, and network infrastructure.
- Transform requirements into functional specifications: considerations include performance, maintainability, extensibility, scalability, availability, deployability, security, and accessibility.
- Transform functional specifications into technical specifications: considerations include performance, maintainability, extensibility, scalability, availability, deployability, security, and accessibility.
- Select the appropriate technologies for the physical design of the solution.
- Create the physical design for:
 - o the solution,
 - o deployment,
 - o maintenance,
 - o the data model.
- Create specifications for auditing and logging
- Validate the physical design.

B1.08 Software engineering principles [1]

- Understand roles of the software engineering process (project manager, software developer, maintenance staff, quality assurance and the user).
- Understand software development life cycle models and their applications.
- Understand and apply software development estimation techniques
- Understand and apply principles of software Project Management
- Understand Risk Management
- Understand Quality Assurance
- Understand Configuration Identification, Control and Auditing
- Understand Configuration Status Accounting
- Understand and apply Software Estimating Techniques and Metrics

C2.04 Essentials of Operating Systems & resource sharing [2]

- Differentiate between the most widespread operating systems:
 - o Linux/Unix, Windows, MacOS
- Cope with OS conceptual problems:
 - o concurrency management, deadlock and starvation
 - o scheduling, I/O operation and management
 - o file management systems
 - o user and access management
- Analyse network capabilities.
- Start and stop various network services.
- Measure and monitor system load:
 - o CPU (both mono- and multi-processor)
 - o network, memory, virtual memory and storage
 - o processes and threads; usage of shared resources
- Manage user accounts and groups and set up related security policies.
- Apply interoperability tips (file formats, available protocols, etc.)
- Manage RAID technology, NAS e SAN subsystems
- Manage Backup libraries
- Explain and differentiate between different resource sharing principles:
 - o the DAC, MAC, RBAC policies
 - o the purposes of file sharing
 - o different permission levels
 - o the concepts of login and logon-script
 - o different types of shareable objects: files, folders, printers, modems, ...
- Check the available shared resources in a network.
- Control the permissions to shared resources.
- Evaluate the risk associated with a network logical drive.
- Connect a client to a shared resource on a server.
- Distinguish between Peer to Peer and Domain based Networks.
- Use the shared resource manager utilities.
- Access shared objects (disks, directories, modem, printers) using Windows, Apple Macintosh, Linux/Unix.
- Use sharing services through VLAN over the Internet.

C4.05 Web exploitation essentials [1]

- Contribute to policy on the construction of an organisation's website, with particular reference to ease of use and adherence to standards.
- Define measurable goals and objectives for websites.
- Appreciate the different roles in web site development.
- Contribute to defining web site goals and objectives.
- Contribute to organising content into web pages.
- Define web site structures.
- Specify response times and evaluate technology issues with these needs.
- Contribute to testing the web site and usability inspection.
- Appreciate Web Technology features (components: browsers, servers, linking to data sources, security, tools).

- Analyse, structure and present information in a way that meets the specific needs of the audience and their business scenarios.
- Configure clients and support users in understanding:
 - o the role of the server
 - o the role of the client and the configuration of its browser
 - o the operations of HTTP and S-HTTP protocols
 - o the concept of the Common Gateway Interface (CGI)
- Install configure and manage a simple web service.
- Explain how to distinguish a secure connection from an insecure one and when it is necessary to use a secure transaction.

B4.03 Build internet applications [1]

- Create form modules, including components for database interaction and GUI controls.
- Reuse objects and code.
- Choose appropriate data sources for data blocks.
- Ensure application security.
- Create and manage multiple-form Internet applications.
- Handle the notion of stateless connection and use of sessions

Annexes

Sample Learning Modules	EUCIP Points
EUCIP CORE PLAN	X
EUCIP CORE BUILD	X
EUCIP CORE OPERATE	X
ITIL (by EXIN or ISEB)	
<i>IT Service Mgmt. Foundations</i>	A 3/5
Univ. Information Systems	A 2/5 E 2/4
Univ. SW Engineering	B 3/9
Univ. Data Bases	B 5/9
Univ. IT Security	A 3/5
<i>IBM Test 287: Enterprise Application Development with WebSphere Studio v5</i>	C 2/4
Microsoft Certified Application Developer (MCAD) <i>MS 70-310: Developing XML Web Services and Server Components with Microsoft Visual Basic .NET and the Microsoft .NET Framework</i> <i>OR 70-320: Developing XML Web Services and Server Components with Microsoft Visual C# .NET and the Microsoft .NET Framework</i>	C 2/4
Microsoft Certified DB Administrator (MCDBA) <i>MS 70-229: Designing and Implementing Databases with Microsoft SQL Server 2000 Enterprise Edition</i>	B 1/9 D 3/8
Microsoft Certified Systems Administrator (MCSA) <i>MS 70-291: Implementing, Managing, and Maintaining a Microsoft Windows Server 2003 Network Infrastructure</i>	C 2/4
Oracle9i Database Administrator <i>1Z0-007: Introduction to Oracle9i SQL</i>	B 2/9
<i>1Z0-031: Oracle9i Database Fundamentals I</i>	D 3/8
<i>1Z0-032: Oracle9i Database Fundamentals II</i>	D 3/8
<i>1Z0-033: Oracle9i Database Performance Tuning</i>	D 3/8
Oracle Database 10g Administrator <i>1Z0-042: Oracle Database 10g Administration I</i>	B 1/9 D 3/8
<i>1Z0-043: Oracle Database 10g Administration II</i>	D 3/8
Oracle Certif. Developer <i>1Z0-141: Oracle Forms Developer - Build Internet Applications</i>	B 2/9
Sun Certif. Network Administrator for the Solaris OS	C 2/4
Sun Certif. Web Component Developer for J2EE	C 2/4

External references to SFIA[®] version 3 by the SFIA Foundation

Skill 18: Data analysis

“The provision of specialist expertise and practical assistance in the investigation, evaluation and interpretation of data in order to ensure its coherence, availability, accuracy and security to meet information and communication systems requirements.”

Levels 4 and 5

Skill 21: Database design

“The specification, design and maintenance of structures for information storage and access to support business information needs.”

Levels 4 and 5

Skill 54: Database administration

“The installation, configuration, upgrade, administration, monitoring and maintenance of physical databases.”

Levels 4 and 5

Skill 50: Data protection

“The development and implementation of policies, procedures, working practices and training to comply with the requirements of legislation regulating the holding, use and disclosure of personal information such as, in the UK, the Data Protection Act, Computer Misuse Act, Freedom of Information Act.”

Level 5

Skill 46: Security administration

“The authorisation and monitoring of access to IT facilities or infrastructure in accordance with established organisational policy. Includes the investigation of unauthorised access, compliance with data protection and performance of other administrative duties relating to security management.”

Levels 4 and 5

External references to AITTS by the German Government – *Arbeitsprozessorientierten Weiterbildung in der IT-Branche*

Profil 1.4: Database Developer (Datenbankentwickler/in)

“Database Developer konzipieren und implementieren Datenbanken.”

Profil 5.3: Database Administrator (Datenbankadministrator/in)

“Database Administrator installieren, konfigurieren, betreiben, überwachen und pflegen Datenbanken.”

External references to *Nomenclature 2005* by CIGREF (club informatique des grandes entreprises françaises)

Métier 3.5b: Administrateur de bases de données

“Il gère et administre les systèmes de gestion de bases de données de l’entreprise, en assure la cohérence, la qualité et la sécurité.

Il participe à la définition et à la mise en œuvre des bases de données et des progiciels retenus par l’entreprise.”