



## Faculty of Science and Technology

### Department of Computing & Informatics

<b>Unit Title: Data Management (COMP5001)</b>		
<b>Assessment Title:</b> Assignment – Database Design and Development and Data Management		
<b>Unit Level:</b> 5	<b>Assessment Number:</b> 1 of 2	
<b>Credit Value of Unit:</b> 20	<b>Date Issued:</b> 27/09/2021	
<b>Unit Leader:</b> Dehao Wu	<b>Submission Due Date:</b> 12/11/2021	<b>Time:</b> 12:30 PM
<b>Other Marker(s):</b> N/A	<b>Submission Location:</b> Brightspace	
<b>Quality Assessor (QA):</b> Rashid Bakirov	<b>Feedback Method:</b> Turnitin	

**This is an individual assignment which carries 50% of the final unit mark.**

### ASSESSMENT TASK

You are required to solve all 4 problems below and include the methodology followed and the solutions in a report.

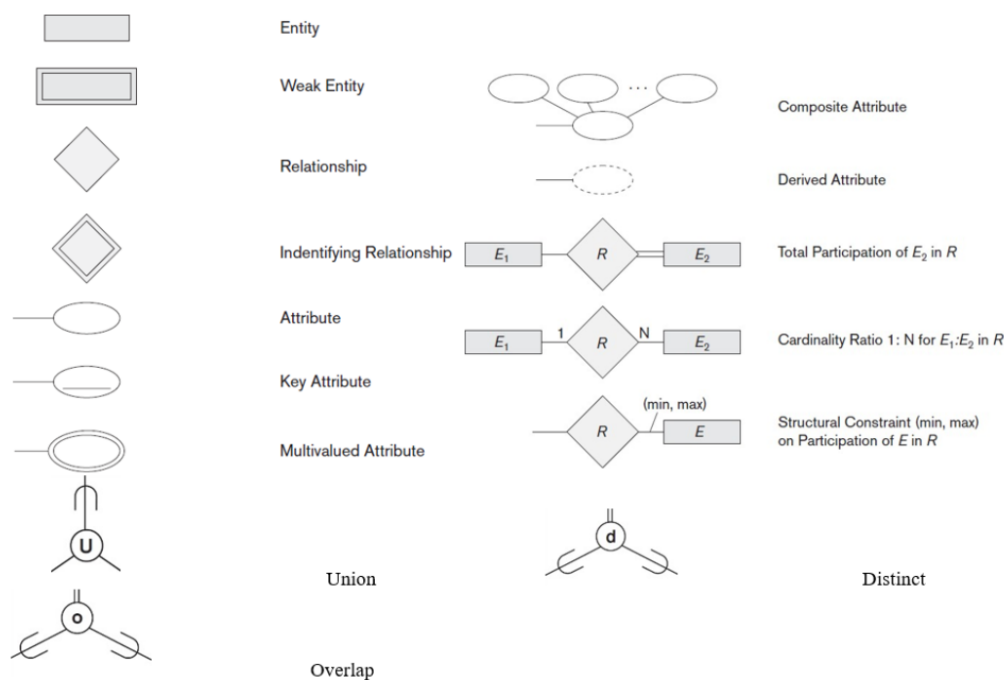
#### PROBLEM 1 (25 marks)

The School of Science and Technology in a university is planning to build a database to schedule Rooms for exams.

Following the analysis of the requirements, the following observations were made:

- A room has a room number, capacity, and building name.
- The exams include experimental Lab sessions and paper exams. Therefore, the room type includes Lab and classroom. The Lab exams have different types, including a computer lab, mechanical lab, electrical lab, and electronics lab. For computer labs, some labs have specific software, e.g specific software for machine learning modules, animation design, product design, and electrical and electronics design.
- A course has a course number, credit, and course name. Each course can have zero or more courses as pre-requisites. A course has sections with section number, time, room, and number of students.
- An exam has a name, date, and unique exam ID, and it belongs to only one section. Each exam must be held in at least one room.
- Each exam has one instructor. The instructor could be an academic staff or non-academic staff. Each instructor has the contact information including phone number, office number, email address, name, and title. Each instructor works in one section. A section has identifier Section ID and attribute Enrollment Limit. Each instructor has his or her own timeslot table, which has a start time, end time and date.
- One room can hold maximum one exam.
- A student has student ID, name, date of birth and year enrolled. Students can enrol in several class-sections in one semester.
- Students take the exams and receive grades.

Draw an Enhanced Entity Relationship diagram (**EER diagram**) for this project. Be sure to indicate the various attributes of each entity and relationship set, and the relationship multiplicities. The notation illustrated in **Figure 1** below **must be used**. Single or double lines should be used, independently of the default illustration in **Figure 1**, depending on the completeness of the specialisation. Additional lines or symbols could be used where necessary.



**Figure 1.** ER and EER diagram symbols

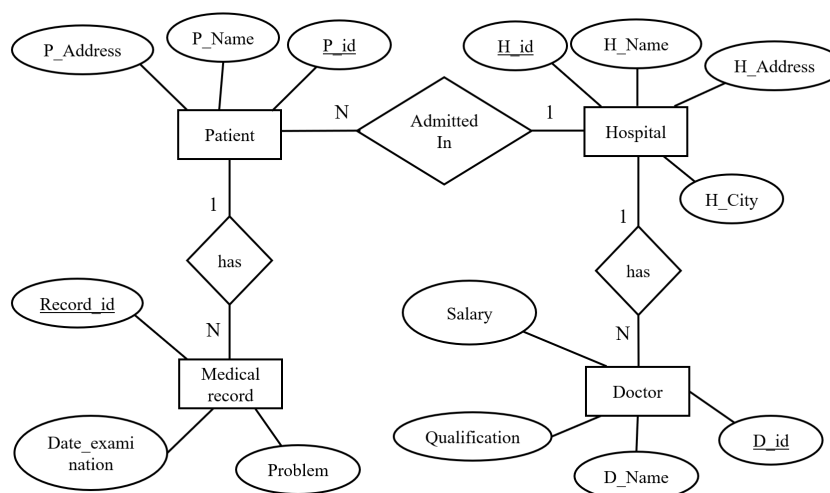
### PROBLEM 2 (25 marks)

Convert the following Entity Relationship diagram illustrated in **Figure 2** into a relational schema.

Include a description of the steps followed for the conversion, as well as an explanation of how these steps were applied for this Entity Relationship Diagram. Be sure to indicate all primary (underline) and foreign key (\*) references.

That is, your answer should look similar to this:

`TABLENAME(attribute1, attribute2*, attribute3 .... )`



**Figure 2.** A hospital database with a set of patients and doctors

**PROBLEM 3 (25 marks)**

For the ER diagram illustrated in Figure 2 of Problem 2, the management team of the hospital wants to make the database available to the regulator for monitoring and inspection, so that they can have access to historical data. In order to facilitate fast access to the database and for security reasons you are required to do the following:

1. Discuss the different implementation options you have when converting the database to a relational schema. Are there any advantages or disadvantages of the different choices one might select, and if yes, what are these?
2. Identify one table that is a good candidate for horizontal partitioning. Give an example SQL code for this partitioning. Use imaginary data for writing the corresponding queries. Explain why you chose to partition this table.
3. Identify a good candidate for vertical partitioning. Give an example SQL code for this partitioning. Use imaginary data for writing the corresponding queries. Explain why you chose to partition this table.

**PROBLEM 4 (25 marks)**

Given a relation  $R\{A, B, C, D, E\}$  with the following set of functional dependencies which are known to be correct:

$A \twoheadrightarrow E$

$BC \twoheadrightarrow A$

$DE \twoheadrightarrow B$

Determine the following (you must show the steps followed for determining the solution):

1. Determine the candidate keys for the relation R.
2. Explain whether the relation R is in BCNF or not, if no, decompose it into a collection of BCNF relations.

**SUBMISSION FORMAT**

Report of up to 800 words (excluding references, tables and figures). Please submit a **PDF** of your report electronically via Brightspace

**MARKING CRITERIA**

The following criteria will be used to assess the assignment:

Indication about maximum possible marks:

**Problem 1 (25%, ILO: 1,2,4):**

- Having correct entity types or a relationship types: 4 marks
- Having correct entity or relationship attributes: 4 marks
- Having correct cardinalities: 4 marks
- Having correct keys: 4 marks
- Having correct multiplicities: 3 marks
- Having correct Specialisations: 3 marks
- Having correct modelling of a part: 3 marks

**Problem 2 (25%, ILO: 2, 3, 4):**

- Having correct table: 5 marks
- Having all correct entity or relationship attributes: 10 marks
- Having all correct keys: 5 marks
- Having more tables when necessary: 5 marks

**Problem 3 (25%, ILO: 2, 3, 4, 5):**

- Question 3-1: 7 marks
- Question 3-2: 8 marks
- Question 3-3: 8 marks

**Problem 4 (25%, ILO: 1, 2, 4):**

- Question 4-1: 15 marks (Derivation steps for solutions are required)
- Question 4-2: 10 marks (Derivation steps for solutions are required)

**A pass is achieved** when there is evidence of sufficient knowledge of techniques for optimising database performance, creating database models and understanding of the relevant algorithms or steps.

**A higher mark is achieved** when there is evidence of holistic understanding of techniques for optimising database performance, creating database models and the relevant algorithms or steps, including a clear outline of the methodology followed.

### INTENDED LEARNING OUTCOMES (ILOs)

This unit assesses your ability to:

1. Evaluate alternative strategies for distributed database design.
2. Understand and apply techniques for optimising database performance.
3. Discuss the advantages and disadvantages of different data and database models.
4. Analyse a complex data modelling problem and apply entity modelling techniques and normalisation to construct a suitable relational data model.
5. Understand data warehousing and the data mining process including a selected set of data mining techniques.

### QUESTIONS ABOUT THE BRIEF

Questions about the brief will be handled during seminar/lab sessions. Please contact the unit leader via email regarding questions about the brief ([dwu@bournemouth.ac.uk](mailto:dwu@bournemouth.ac.uk)) when no seminar/lab session are scheduled between the time the questions arise and the submission deadline.

Unit Leader Signature Dehao Wu

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# Help and Support

## Undergraduate Coursework Assessments

If a piece of coursework is not submitted by the required deadline, the following will apply:

1. If coursework is submitted within 72 hours after the deadline, the maximum mark that can be awarded is 40%. If the assessment achieves a pass mark and subject to the overall performance of the unit and the student's profile for the level, it will be accepted by the Assessment Board as the reassessment piece. The unit will count towards the reassessment allowance for the level; This ruling will apply to written coursework and artefacts only; This ruling will apply to the first attempt only (including any subsequent attempt taken as a first attempt due to exceptional circumstances).
2. If a first attempt coursework is submitted more than 72 hours after the deadline, a mark of zero (0%) will be awarded.
3. Failure to submit/complete any other types of coursework (which includes resubmission coursework without exceptional circumstances) by the required deadline will result in a mark of zero (0%) being awarded.

The Standard Assessment Regulations can be found on **Brightspace** or via <https://www1.bournemouth.ac.uk/students/help-advice/important-information> (under Assessment).

## Exceptional Circumstances

If you have any valid **exceptional circumstances** which mean that you cannot meet an assignment submission deadline and you wish to request an extension, you will need to complete and submit the online Exceptional Circumstances Form together with appropriate supporting evidence (e.g. GP note) normally **before the coursework deadline**. Further details on the procedure and links to the exceptional circumstances forms can be found on **Brightspace** or via <https://www1.bournemouth.ac.uk/students/help-advice/looking-support/exceptional-circumstances>. Please make sure that you read these documents carefully before submitting anything for consideration. For further guidance on exceptional circumstances please contact your Programme Leader.

## Referencing

You must acknowledge your source every time you refer to others' work, using the **BU Harvard Referencing** system (Author Date Method). Failure to do so amounts to plagiarism which is against University regulations. Please refer to <https://libguides.bournemouth.ac.uk/bu-referencing-harvard-style> for the University's guide to citation in the Harvard style. Also be aware of Self-plagiarism, this primarily occurs when a student submits a piece of work to fulfill the assessment requirement for a particular unit and all or part of the content has been previously submitted by that student for formal assessment on the same/a different unit. Further information on academic offences can be found on **Brightspace** and from <https://www1.bournemouth.ac.uk/discover/library/using-library/how-guides/how-avoid-academic-offences>

## Additional Learning Support

Students with **Additional Learning Needs** may contact the Additional Learning Support Team. Details can be found here: <https://www1.bournemouth.ac.uk/als>

## Primary Research (Undergraduate Levels)

You should not be conducting any primary research (i.e. carrying out an investigation to acquire data first-hand, for example, where it involves approaching participants to ask questions or to participate in surveys, questionnaires, interviews, observations, focus groups, etc.) unless otherwise specified in the brief. However, if there is a genuine requirement to collect primary research data you will require ethical approval before doing so. In the first instance, please discuss with the Unit Leader. The collection of primary data without appropriate ethical approval is a serious breach of Bournemouth University's [Research Ethics Code of Practice](#) and will be treated as Research Misconduct.

## IT Support

If you have any problems submitting your assessment please contact the IT Service Desk - +44 (0)1202 965515 - immediately and before the deadline.

## Disclaimer

The information provided in this assignment brief is correct at time of publication. In the unlikely event that any changes are deemed necessary, they will be communicated clearly via e-mail and Brightspace and a new version of this assignment brief will be circulated.