**CQUniversity. Term1-2020**

**Complete the following:**

**Student Id: 12116421**

**First name: Bishal**

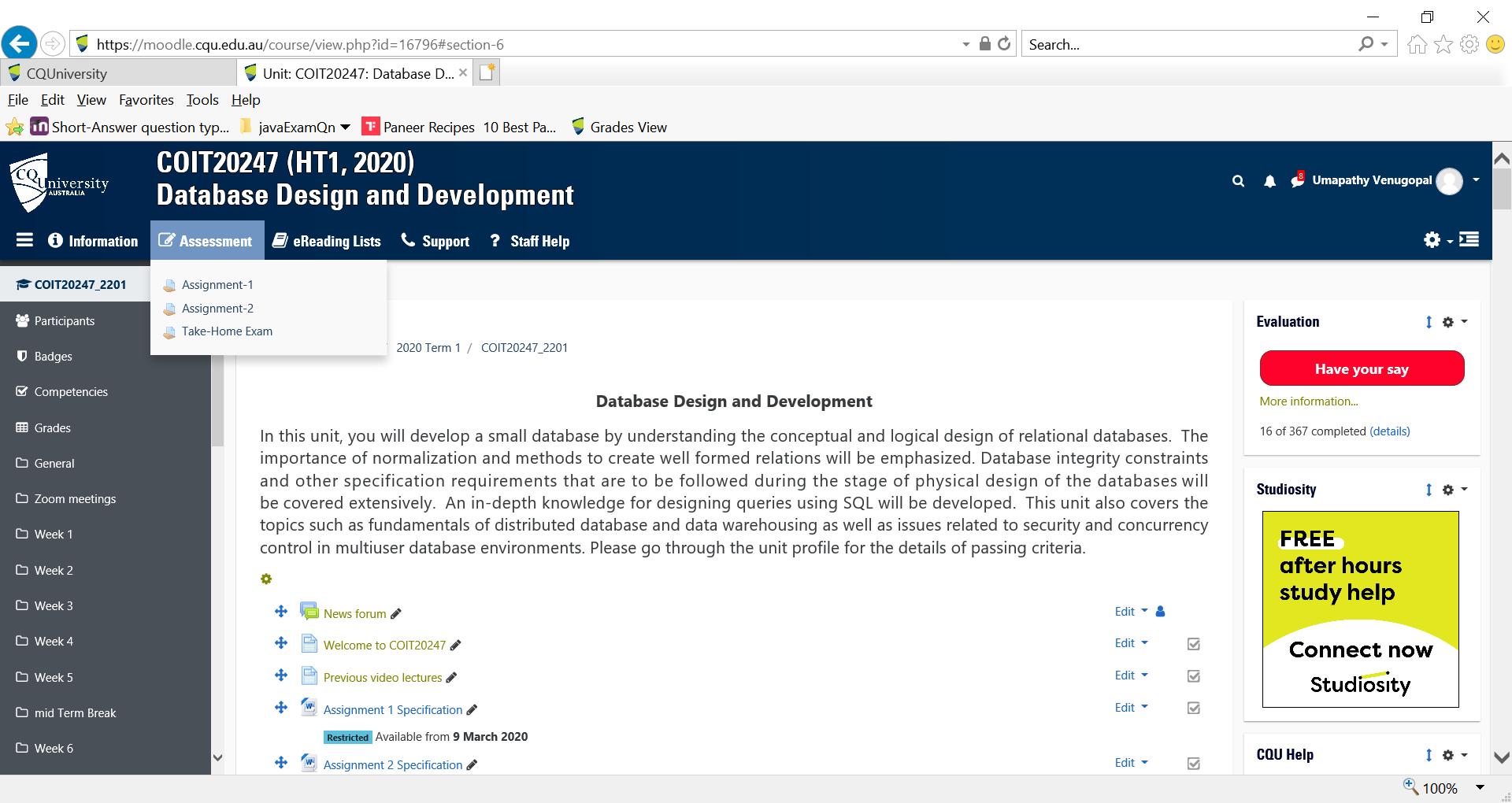
**Last name: Budhathoki**

**Campus details: Sydney In-campus**

# Instructions Sheet

**Due date and Time: 09:00 hrs on June 18, 2020.**

1. **Go to the end of this document and start writing all your answers clearly stating the question number. E.g., Part A Question1 a).**
2. **Submit this document, containing all your answers, through the sub-menu ‘Take-Home Exam’ under the ‘Assessment’ menu in the unit website (COIT20247).**



1. **This Take-Home Exam comprises three parts, Part A, B and C.**
2. **Students should attempt all questions in all parts.**
3. **The total marks available in the Take-Home Exam are 35.**

**Take-home exam guidelines**

* The take-home exam should take you 2 (two) hours to complete. However, you will be given a 24-hour timeframe, between which you will need to download the exam from the unit’s Moodle website, complete it and upload it back.
* The exam will be made available on Wednesday 17/06/2020 09:00 hrs through the Assessment tab of the Moodle unit website. The unit coordinator will be accessible for any exam-related queries for one hour after the release of the exam. The unit coordinator can be reached at (02) 9324 5789/ u.venugopal@cqu.edu.au
* Your typed answer script in Microsoft Word file format needs to be uploaded by 18/06/2020 09:00 hrs. The submission link may become unavailable after this time. Any submission after the deadline may not be accepted. Please ensure you submit the correct file.
* All submissions will be processed via Turnitin®.
* You are required to do your own work, maintaining academic integrity with all honesty. If the marker suspects a breach of academic integrity, you may be requested to attend a real-time interview via Zoom to confirm your understanding of your submission. Inability to explain or justify given solutions may result in allegations of academic misconduct.
* The marks for your assessed answer script will be made available on Certification of Grades day (10 July). Like a regular exam, the assessed answer script will not be returned to you, unless you apply to see it as part of the first step of the review of grade process, which is an informal consultation.
* If you are unable to take the exam on the specified date due to illness or some other exceptional circumstances, you need to apply for a Deferred Assessment via the Assessment Extension Request Link on the Moodle unit page and supply the necessary documentation. Be aware that Deferred Assessment applications will be refused if there are not sufficient grounds and/or supporting documentation. Note also that a Deferred Assessment is NOT a normal extension. Should your application be accepted, you will be required to take a different assessment at a specified time up to several weeks after the Term 1 grades are certified. This will mean you will not receive a Term 1 grade at the normal certification time.
* For further details. please refer to the Assessment Policy and Procedure (Higher Education Coursework), which can be found through this link (<https://www.cqu.edu.au/policy>)
* For any technology-related issues, please contact the Technology and Services Assistance Centre (TASAC) on the details provided through this link (<https://www.cqu.edu.au/about-us/structure/directorates/information-and-technology>)

## PART A 17 MARKS

**DATA MODELLING QUESTIONS**

**Students are required to answer ALL questions from this part.**

All questions in this part relate to the ER model given below. The ER model illustrates the entities and relationships for AC installation model. Examine the ER model below and **answer all the questions** that follow.

**Note:** A customer can request for many jobs; a job can be an installation or a repair; an installation can be wall mounted or ducted installation.

## ER model:

## 

**Question 1 4 Marks**

**Data Modelling**

According to the ER model given above, answer either ***yes***or ***no***to the following questions:

1. Can a job belong to more than one customer? **(1 mark)**
2. Every installation must have at least one repair. **(1 mark)**
3. A job type can be neither an installation nor a repair. **(1 mark)**
4. If an installation is Wall/Window mounted, then it cannot be a ducted one.

**(1 mark)**

## Question 2 4 Marks

1. Explain the total and partial specialisations that have been used in the ER model.

**(1 mark)**

1. List the reasons for using disjoint classification in the ER model. **(1 mark)**
2. List the discriminator attributes that have been used in the ER model. **(1 mark)**
3. Explain the use of multi-valued attribute in the ER model. **(1 mark)**

## Question 3 5 Marks

**Converting ER models**

Convert the ER model given in Part A into a set of relations that satisfy Third Normal Form (3NF). You **do not** need to show your workings. **You do not need to justify that they are in 3NF** at this stage. You **do not** need to show sample data. Just show your relations. You should write your relations in either format shown below:

Student (StudentID, StudentName, DateOfBirth)

Enrolment (EnrolmentID, StudentID, DateOfEnrolment)

or:

Student (StudentID, StudentName, DateOfBirth)

Enrolment (EnrolmentID, StudentID, DateOfEnrolment)

Foreign key (StudentID) references Student

## Question 4 4 Marks

**Relational model and Normalisation**

An **incorrect** relation **Installation** has been shown below. The primary key of the relation is InstallationId. Examine the relation and answer the questions that follow.

**Note:** A customer can request for many installations

**Installation**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| InstallationId | Date | Address | CustomerId | CustomerName | Cost ($) |
| 1 | 21/2/2020 | 333 Kent St, Sydney | C001 | John Smith | 2000 |
| 2 | 24/2/2020 | 400 Kent St Sydney | C001 | John Smith | 7200 |
| 3 | 24/2/2020 | 17 Elizabeth St, Campsie | C002 | Mary Smith | 2000 |
| 4 | 25/2/2020 | 432 Parramatta Rd, Redfern | C003 | Rose Miller | 2000 |

1. Details related to a new Customer such as “C004, Krishna Kumar” have to be entered and stored in the above **Installation** relation. What will happen when such details only have to be stored without any relevant installation detail? **(1 mark)**
2. What is the highest normal form that **Installation** relation satisfies and why?

**(1 mark)**

1. Normalise the above-mentioned **Installation** relation into a set of relations that satisfy 3NF. **You need not show your work out. Write the final relations only.** You need to use the following format:

Customer (CustomerID, CustomerName) Order (OrderID, Amount, Date, *CustomerID*)

Foreign key (CustomerID) references Customer

## (2 marks)

**PART B 10 MARKS**

**STRUCTURED QUERY LANGUAGE QUESTIONS**

**Students are required to answer ALL questions from this part.**

**Each question is worth two marks (5 x 2 = 10 marks).**

Formulate SQL queries to answer the following information requests. Use the relations *Customer, Job, EmpJob* and *Employee* that have been provided below.

**Note:** **A Customer can request for many jobs; an employee can work on many jobs and in one job many employees can work.**

**In Job table, the JobType attribute value should not be null and can have the data value either “Installation” or “Repair” only.**

## Relations

Customer (CustomerID, CustomerName, ContactNumber, StreetAddress, City, PostCode)

Job (JobId, JobRequestDate, JobType, TotalCharges, CustomerId)

Foreign key (CustomerID) references Customer

Employee (EmployeeId, EmployeeName, Position)

EmpJob (JobId, EmployeeId, NumberOfHours)

Foreign key (JobId) references Job

Foreign key (EmployeeID) references Employee

**Tables**

**Customer**

| **CustomerID** | **CustomerName** | **ContactNumber** | **StreetAddress** | **City** | **PostCode** |
| --- | --- | --- | --- | --- | --- |
| 1 | John Smith | 0424100200 | 333 Kent St | Sydney | 2000 |
| 2 | Lisa Carpenter | 0325123321 | 400 Kent St | Sydney | 2000 |
| 3 | Peter Hairy | 0421456789 | 123 Marion St | Pyrmont | 2002 |

**Job**

| **JobId** | **JobRequestDate** | **JobType** | **TotalCharges** | **CustomerId** |
| --- | --- | --- | --- | --- |
| 1 | 20/04/2019 | Installation | $400.00 | 1 |
| 2 | 20/05/2019 | Repair | $45.00 | 2 |
| 3 | 20/05/2019 | Installation | $600.00 | 1 |

**Employee**

| **EmployeeId** | **EmployeeName** | **Position** |
| --- | --- | --- |
| 1 | Maria Kumar | Mechanic |
| 2 | Penny Swift | Electrician |
| 3 | Arthur Smoke | Welder |
| 4 | James Wheeler | Mechanic |
| 5 | Peter Rocket | Electrician |

**EmpJob**

| **JobId** | **EmployeeId** | **NumberOfHours** |
| --- | --- | --- |
| 1 | 1 | 8 |
| 1 | 2 | 4 |
| 1 | 4 | 8 |
| 2 | 5 | 4 |
| 3 | 1 | 8 |

## Note:

* You need to provide a general solution to each request. If the database contents change, each of your queries should continue to provide the information requested correctly.
* Simple queries are preferred; if your queries are unnecessarily complex you may lose marks.
* For the given sample data, your queries should be able to generate the same data and column names as shown in the result table for each request.
* You are not required to sort the results in any order unless requested.
* State any assumptions that you make to clarify your understanding of the information request.

## Question 1 (2 marks)

Show the Employees who have never performed any Job.

| **EmployeeId** | **EmployeeName** | **Position** |
| --- | --- | --- |
| 3 | Arthur Smoke | Welder |

## Question 2 (2 marks)

Display the details of employees whose name contains the word ‘pen’.

| **EmployeeId** | **EmployeeName** | **Position** |
| --- | --- | --- |
| 2 | Penny Swift | Electrician |

## Question 3 (2 marks)

Display the details of employees who have performed only Installation type Jobs.

| **EmployeeId** | **EmployeeName** | **Position** |
| --- | --- | --- |
| 1 | Maria Kumar | Mechanic |
| 2 | Penny Swift | Electrician |
| 4 | James Wheeler | Mechanic |

## Question 4 (2 marks)

Display the details of employees who have performed only Repair type Jobs.

| **EmployeeId** | **EmployeeName** | **Position** |
| --- | --- | --- |
| 5 | Peter Rocket | Electrician |

## Question 5 (2 marks)

Display the details of employees who have performed at least one job in ascending order of their names.

| **EmployeeId** | **EmployeeName** | **Position** |
| --- | --- | --- |
| 4 | James Wheeler | Mechanic |
| 1 | Maria Kumar | Mechanic |
| 2 | Penny Swift | Electrician |
| 5 | Peter Rocket | Electrician |

## PART C 8 MARKS

**SHORT-ANSWER THEORY QUESTIONS**

**Students are required to answer ALL questions from this part.**

**Each question is worth two marks (4 x 2 = 8 marks).**

**Question 1 (2 marks)**

Briefly describe 3rd Normal Form of a Relation and provide the detailed steps to obtain the 3rd Normal Form of the relations for the question in Part A-Question-3.

**Question 2 (2 marks)**

What is data integrity? By using the relations from Part B, explain what is meant by the following:

* + Entity integrity rule
  + Referential integrity rule

**Question 3 (2 marks)**

Why are locks used in multiuser database environment? Explain the difference between an exclusive lock and a shared lock.

**Question 4 (2 marks)**

Compare and contrast Data Warehousing against Database.

--End of Take-Home Exam—

Start your answers from here:

**Part A Question1**

1. No
2. No
3. No
4. Yes

**Part A Question 2 a.**

Total specialisation used: INSTALLATION, REPAIR because supertype instances of JOB must be an instance of subtype INSTALLTION, REPAIR.

Partial specialisation used: WALL/WINDOW\_MOUNTED, DUCTED because supertype instances of INSTALLATION does not have to be an instance of WALL/WINDOW\_MOUNTED, DUCTED and another instance can exist also.

**Part A Question 2 b.**

Disjoint classification is used because of supertype entity INSTALLATION can be a part of WALL/WINDOW\_MOUNTED or DUCTED at a time. So, InstallationType can be either WALL/WINDOW\_MOUNTED or DUCTED.

**Part A Question 2 c.**

Discriminator Attributes

For JOB entity, JobType is discriminator attributes.

For INSTALLATION entity, InstallationType is discriminator attributes.

**Part A Question 2 d.**

Multi-valued attribute which is ZoneName and NumOutlets both can have many zones like hall, living-room and different values for NumOutlets for individual zone for InstallationType = Ducted.

**Part A Question 3**

CUSTOMER (*CustomerId*, CustomerName, StreetAddress, City, PostCode, ContactNum)

JOB (*JobId*, JobRequestDate, DateScheduled, JobStartDate, JobEndDate, JobType, TotalCharges, *CustomerId*)

Foreign key (*CustomerId*) references CUSTOMER

INSTALLATION (*InstallationId*, *JobId*, StreetAddress, City, PostCode, InstallationType)

Foreign key (*JobId*) references JOB

REPAIR (*JobId*, Problem, *InstallationID*)

Foreign key (*InstallationID*) references INSTALLATION

Foreign key (*JobId*) references JOB

WALL/WINDOW\_MOUNTED (*InstallationId*, location)

Foreign key (*InstallationId*) references INSTALLATION

DUCTED (*InstallationId*, *ZoneId*)

Foreign key (*InstallationId*) references INSTALLATION

Foreign key (*ZoneId*) references ZONE

ZONE (*ZoneId*, ZoneName, NumOutlets)

**Part A Question 4 a.**

For this relation, complete data for the relation will be required else Insertion Anomaly occur. Insertion anomaly occurs when incomplete data is tried to insert in the database where database demand for complete data for the relation.

**Part A Question 4 b**.

Given relation is in 1NF because:

Here possible candidate key is (InstallationId, CustomerId).

The functional dependencies in the given relation-table are:

(InstallationId, CustomerId) -> Cost

CustomerId -> CustomerName.

So, partial dependency is CustomerId -> CustomerName in the given relation because (CustomerId) which is the functional determinant, is only part of the candidate key. This does not validate the 2NF.

**Part A Question 4 c.**

Installation (*InstallationId*, Date, Address, Cost)

Customer (*CustomerId*, CustomerName)

**Part B Question 1**

SELECT \*

FROM EMPLOYEE

WHERE EmployeeId NOT IN (SELECT EmployeeId FROM EmpJob);

**Part B Question 2**

SELECT \*

FROM EMPLOYEE

WHERE EmployeeName ALIKE ‘%pen%’;

**Part B Question 3**

SELECT \*

FROM EMPLOYEE

WHERE EmployeeId IN (SELECT EmployeeId FROM EmpJob WHERE JobId IN (SELECT JobId from Job Where JobType= 'Installation'));

**Part B Question 4**

SELECT \*

FROM EMPLOYEE

WHERE EmployeeId IN (SELECT EmployeeId FROM EmpJob WHERE JobId IN (SELECT JobId from Job Where JobType= 'Repair'));

**Part B Question 5**

SELECT DISTINCT Employee.EmployeeId, Employee.EmployeeName, Employee.Position

FROM EMPLOYEE

INNER JOIN EmpJoB ON EMPLOYEE.EmployeeId=[EmpJob].EmployeeId

ORDER BY EmployeeName;

**Part C Question 1**

Third Normal Form states that the relation should be in 2NF and there should not be any transitive functional dependencies and transitive functional dependencies exists when a candidate key is present say A and A determines different non key attribute A->B and B determines different non-key attribute B->C where A, B, C are attributes in a relation and B, C being non key attributes.

So, for Question 3 to be in 3NF, 1NF should be true that is every tuple is unique and no repeated or multivalued attribute. Then check for partial dependency should not be there else create separate table for relation with proper primary key and attributes. And then transitive dependencies. If it exists then it is not in 3NF. Remove transitive dependencies creates 3NF.

JOB (*JobId*, JobRequestDate, DateScheduled, JobStartDate, JobEndDate, JobType, TotalCharges, *CustomerId*)

Here, it has no multivalued attribute, all tuple is unique, contains primary key. So is in 1NF. There are no transitive dependencies as no candidate key is not composite. It is in 2NF. There are no transitive functional dependencies as determinant and it attribute are not outside candidate key. Hence it is in 3NF.

**Part C Question 2**

Data that is accurate, consistent and valid is known to be data integrity.

Entity integrity rule states that

* tuples are unique like EmployeeId, EmployeeName, Position are unique tuples for Employee entity
* primary key is a must for every table and must be unique like JobId is the primary key for Job entity and it is unique for individual job request.
* primary key cannot be null like CustomerId is unique and not empty for every individual customer.
* every individual entity must be unique like Customer, Job, Employee, EmpJob are unique entities.

Referential Integrity Rule states that foreign key must have a matching and similar primary key, having same data types and reference from one table to another table must be valid. Example EmpJob relation has a foreign key EmployeeId which is a primary key of Employee, CustomerId is a foreign key for Job relation which is primary key for Customer entity.

**Part C Question 3**

Locks in multiuser database helps us by preventing different users/ applications from getting access to the exact same data at the very same time.

If the transaction is read only for a resource then shared lock is applied on the resource. So, if one process applies S-lock and if another resource wants to access the same file then that transaction can also be done by using S-lock.

If the transaction is to update the resource that is getting accessed then exclusive lock is applied on the resource. Unlike shared lock if exclusive lock is used then other locks can not be used making other transactions to get delayed causing deadlock.

**Part C Question 4**

Database is a collection of similar and related data, organised in such a way that it can be accessed, managed and updated. It provides security to the data and access concurrent data permission. It also provides insulation between programs/software and data.

Datawarehouse collects and combines data from various resources into one comprehensive database to analyse, combine transaction from multiple resources and report. It reduces total turnaround time for analysis and making report. It is non- delete able as it is non-volatile in nature when new data is entered.