Project

Faculty Name:	Information Technology
Module Code:	ITDA310
Module Name:	Advanced Database Systems Semester 1
Module Leader:	Deborah Oluwadele
Copy Editor:	Kevin Levy
Total Marks:	250
Submission Date:	11/05/2020 – 15/05/2020
Resources Required:	Student Resources folder

This module is presented on NQF level 7.

Mark deduction of 5% per day will be applied to late submission, up to a maximum of three days. Assignments submitted later than three days after the deadline or not submitted will get 0%. [1]

This is an individual assignment.

This project contributes 90% towards the final mark.

Instructions to Student

1. Remember to keep a copy of all submitted assignments.
2. All work must be typed.
3. Please note that you will be evaluated on your writing skills in all your assignments.
4. All work must be submitted through Turnitin[2] and the full Originality Report should be attached to the final assignment. Negative marking will be applied if you are found guilty of plagiarism, poor writing skills or if you have applied incorrect or insufficient referencing. (See the table at the end of this document where the application of negative marking is explained.)

[1] Under no circumstances will assignments be accepted for marking after the assignments of other students have been marked and returned to the students.

[2] Refer to the PIHE Policy for Intellectual Property, Copyright and Plagiarism Infringement, which is available on *my*LMS.

5. Each assignment must include a cover page, table of contents and full bibliography, based on the referencing method applicable to your faculty as applied at Pearson Institute of Higher Education.
6. Use the cover sheet template[3] for the assignment; this is available from your lecturer.
7. Students are not allowed to offer their work for sale or to purchase the work of other students. This includes the use of professional assignment writers and websites, such as Essay Box. If this should happen, Pearson Institute of Higher Education reserves the right not to accept future submissions from a student.

Assignment Format

Students must follow the requirements when writing and submitting assignments as follows:

- Use Arial, font size 10.
- Include page numbers.
- Include a title page.
- Print submissions on both sides of the page.
- Write no more than the maximum word limit.
- Ensure any diagrams, screenshots and PowerPoint presentations fit correctly on the page and are referenced.
- Include a table of contents.
- Use the accurate referencing method throughout the assignment.
- Include a bibliography based on the applicable referencing method at the end of the assignment.
- Include the completed Assessment/Project Coversheet (available on *my*LMS).
- Check spelling, grammar and punctuation.
- Run the assignment through Turnitin software.

Essential Embedded Knowledge and Skills Required of Students

- Report-writing skills
- Ability to analyse scenarios/case studies
- Understanding of subject field concepts and definitions
- Ability to apply theoretical knowledge to propose solutions to real-world problems
- Modelling skills

[3] Available on *my*LMS.

Resource Requirements

- A device with Internet access for research
- A desktop or personal computer for typing assignments
- Access to a library or resource centre
- Prescribed reading resources

Delivery Requirements (evidence to be presented by students)

- A typed assignment consisting of all five deliverables[4]
- A Turnitin Originality Report

Minimum Reference Requirements

At least five references for first year, ten references for second year and fifteen references for third year.

Additional reading is required to complete this assignment successfully. You need to include the following additional information sources:

- Printed textbooks/e-books
- Printed/online journal articles
- Academic journals in electronic format accessed via PROQUEST or other databases
- Periodical articles e.g. business magazine articles
- Information or articles from relevant websites
- Other information sources e.g. geographic information (maps), census reports, interviews

Note

- It is crucial that students reference all consulted information sources, by means of in-text referencing and a bibliography, according to the applicable referencing method.
- Negative marking will be applied if a student commits plagiarism i.e. using information from information sources without acknowledgement and reference to the original source.
- In such cases, negative marking, also known as 'penalty scoring', refers to the practice of subtracting marks for insufficient/incorrect referencing.
- Consult the table at the end of this document, which outlines how negative marking will be applied as well as the way in which it will affect the assignment mark.

[4] Refer to the Conditions of Enrolment for more guidance (available on *my*LMS).

Section A

Learning Objective

The purpose of this practical project is to design, document and implement a MySQL database system and interface it with a third party application.

Assignment Topic

BroadReach: Empowering Actions. Changing Lives.

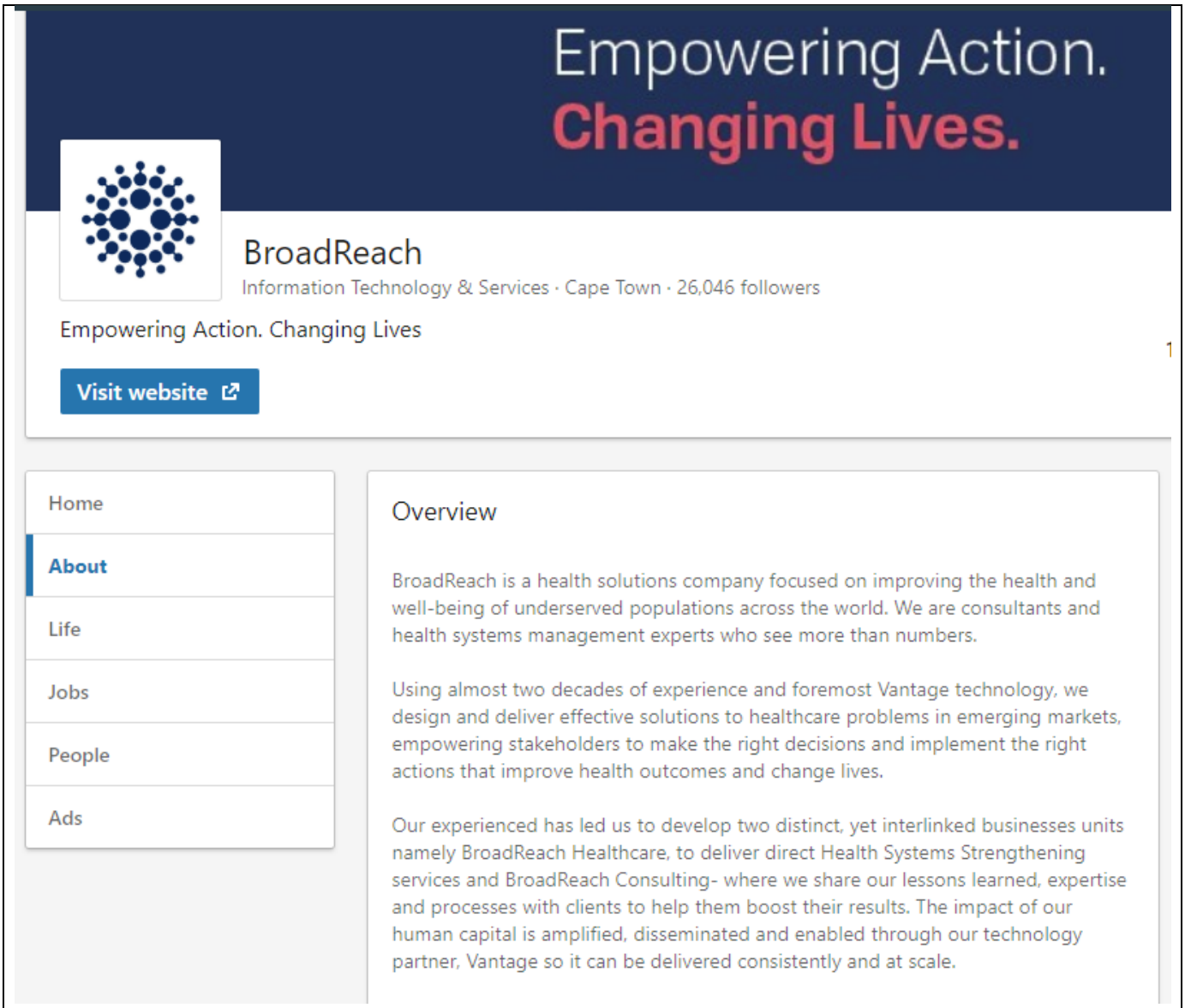
Technical Aspects

The following programming tools are required to complete this project:

- MySQL Workbench for data modelling and database implementation
- Java for interface design and development

Scenario

A. The Background



Source: [Online] https://www.linkedin.com/company/broadreach-healthcare/about/ [Accessed: 14 January 2020]

B. Your Roles

You have the privilege of being employed at BroadReach as the (logical and physical) database designer. As the logical database designer, your duties include identifying data (entities and attributes), the relationships between the data, and the constraints on the data that is to be stored in the database. This entails having a complete and thorough understanding of the organisation's data and any constraints on this data. Recall that these constraints are sometimes called business rules.

As the physical database designer, you also need to design how the logical database design is to be physically realised. This includes mapping the logical database design into a set of tables and integrity constraints, selecting specific storage structures and access methods for the data to achieve good performance, and designing any security measures required on the data.

Besides this, you also need to fulfil the key accountabilities as described in your role description:

Empowering Action.

Role Description

BroadReach is profoundly focused on improving the health and well-being of underserved populations across the globe. We empower governments, donor groups, NGOs and private companies to operate more efficiently, improving outcomes for people in need with our intelligent solutions: A combination of our people, process and our Vantage platform.

Purpose of the position

Engage effective and efficiently within District DOH environment, supporting the implementation of strategies, policies and SOP to improve Data quality dimensions across BroadReach supported facilities through capacitation of internal BroadReach staff and DOH staff. Creating an enabling environment within the business through the development and implementation of solution driven processes and procedures at district and facility level.

Key Accountabilities (included but not limited to)

Seniority Level
Mid-Senior level

Industry
Non-profit Organization Management,
Financial Services,
Hospital & Health Care

Employment Type
Full-time

Job Functions
Information Technology

- Carry out Data analyses to identify critical interpretation of the data that allows for the improvement of programme implementation and management in realising district peak performance and provide guidance and support to the District Director and District Leadership team.
- Support DOH in monitoring of health information systems effectiveness using district health information system policy and related SOPs
- Support all data quality improvement plans activities, ensuring timely issue/risk escalation to Senior Management team
- Train and build capacity of field staff in the understanding of the use of data/ information for decision making and improved outputs/outcomes
- Coordinate the development and implementation of new data collection tools to support the implementation of all data collection requirements including ad-hoc and annual surveys
- Participate in Internal and external planning across supported districts and province (DIP, APP, DHP, Quarterly reviews and Operational Planning)
- Support senior management team in the seamless integration of information management of Sub-recipients within the supported district

Source:https://www.linkedin.com/jobs/view/1684987907/?refId=4137851631581680500539&trk=d_flagship3_company [Accessed: 14 January 2020]

C. The HIS Project

BroadReach has embarked on a Health Information system development project, the aim of which is to electronic communication between the hospital, patient and the Community Healthcare Worker (CHW) in order to enhance access to and provision of quality healthcare.

To help you achieve a full understanding of the requirements of this project, the lead project manager; Caroline Kirsten has conducted a JAD session with all project stakeholders. This session facilitated by Jeremy Goodwill, a senior business analyst at BroadReach with over ten solid years of industry experience, was a successful one. From the JAD session, scenarios were presented which provided a thorough understanding of the requirement of the system.

Scenario 1: Hospital Visit

1. Patient Lindiwe arrives at the hospital and she is registered on the hospital system (web-based application). Each patient receives a unique ID from the national patient identifying system.
2. If a patient is already registered as a result of a different clinical program or a past visit, their record can be found on the hospital system and a new visit is started.
3. Lindiwe queues for the Hospital Clinician until she is called into the consulting room.
4. The clinician examines Lindiwe.
5. The clinician logs onto the hospital system and captures all clinical findings from the patient examination and requests diagnostic tests.
6. The test requests are transmitted to an integrated lab system and a radiology system.
7. Lindiwe has to go to the lab for 4 lab tests and then to radiology for an ultrasound. The tests are processed, and the results are entered on the lab system. Lindiwe returns to the Clinician.
8. The clinician reviews the lab results on the hospital system and diagnoses the patient with HIV, pregnancy and diabetes, and documents the appropriate treatment including prescribed drugs.
9. The prescription details are sent to the integrated pharmacy system.
10. The positive pregnancy result registers Lindiwe on an integrated system call, MomConnect, which sends health messages to pregnant women.
11. The Clinician schedules the required follow up visits:
    a. Diabetes Clinic – Wednesday 15th June 2016 – 8 - 10am
    b. PMTCT – Wednesday 22nd June 2016 – 10am – 12pm
    c. HCW referrals for household visits once a week for risk reduction, adherence support and possible drug deliveries.
12. Lindiwe collects her medication from the pharmacy and leaves the clinic.

Source: Jembi HIS BA Assessment [Accessed: 14 January 2020]

Scenario 2: Community Healthcare Worker

1. Zumo downloads/views her daily work list of patients to visit on her smartphone:
    a. Today she has 10 patients for follow up appointments for risk reduction and adherence support.
    b. 5 patients have a clinic appointment tomorrow.
    c. 4 patients missed their appointment yesterday.

2. The day before Lindiwe's appointment, Zumo received an appointment reminder to say that Lindiwe is due to go to the hospital tomorrow at 8am. These reminders are sent one day prior to each appointment. Details include: Lindiwe's name, appointment type (PMTCT, Diabetic) date and time block.
3. If Lindiwe misses any of her appointments, Zumo receives missed appointment messages.
4. Zumo registers new household members on her phone and captures basic clinical assessment data.
5. Zumo tests patients for blood sugar levels and administers 2 drugs. Details of these interventions are captured on her phone.
6. Zumo presents education videos to the family via her phone. The videos provide support for improving diet and exercise.

Source: Jembi HIS BA Assessment [Accessed: 14 January 2020]

Scenario 3: The Patient

1. Lindiwe receives appointment confirmation messages and a message to say that she is registered on MomConnect on her phone when the receptionist saves her booked appointments on the hospital system
2. The day before her appointment, she receives an appointment reminder message with appointment type (PMTCT, Diabetic) date and time block.
3. Every week, Lindiwe receives the following messages:
    a. Antenatal health messages based on her stage of pregnancy
    b. HIV risk reduction and adherence messages
    c. Diabetes risk reduction and adherence messages.

Source: Jembi HIS BA Assessment [Accessed: 14 January 2020]

Reports

Data is transmitted to a national data centre aggregate reporting system. Example reports include:

1. All patient registrations per hospital
2. Patient missed appointment report
3. HIV patients receiving ART therapy for the current district

Technical Considerations

1. The country has decided to implement the OpenHIE architecture workflows as a starting point for their national health system.

2. Patient records are confidential and must be protected.
3. Fibre connectivity is only available in the cities.
4. Some areas have intermittent internet connectivity.
5. Some areas have zero internet connectivity.
6. Mobile networks are available in 70% of the country.
7. Power is not consistent.

End of Scenario

Based on the above scenarios and requirements, create a database using MySQL workbench, which supports the BroadReach health information system. Your database must consist of the following:

1. Conceptual Database Design

Undertake a thorough analysis for each of the scenarios and identify:

1.1	Entity types	(10 Marks)
1.2	Relationship types	(10 Marks)
1.3	Attributes and attributes domains	(10 Marks)
1.4	Primary keys and alternate keys	(10 Marks)
1.5	Integrity constraints	(10 Marks)

Deliverable: To account for this exercise, provide a conceptual data model which is supported by documentation, including ER diagrams drawn on MySQL workbench, and a data dictionary which shows all tuples in the database, their field names and other relevant details.

[Sub Total 50 Marks]

2. Logical Database Design

Now that you have a conceptual model for your database, you shall translate the conceptual design into a logical database model. Remember to validate this model afterwards to ensure that it is structurally correct and able to support the stipulated scenarios. To do this, you shall:

2.1	Derive relations for logical data models	(10 Marks)
2.2	Validate relations using normalisation	(10 Marks)
2.3	Check integrity constraints	(10 Marks)
2.4	Draw a table which shows the global data model for BroadReach Health Information System	(10 Marks)
2.5	Draw a global ER diagram either hand-drawn or drawn on MySQL workbench.	(10 Marks)

Deliverable: To account for this exercise, produce a document which shows each relation that you have derived from the scenarios above. Normalise these relations to 3NF and show the process of normalisation. Ensure that at the end of the normalisation process, no redundancy is evident in your model. The document must also contain your global data table and ER diagram.

[Sub Total 50 Marks]

3. Physical Database Design

Using the documentation produced as deliverable for Task 2, you shall now produce the implementation of the BroadReach Health Information System. To fulfil this requirement, you shall:

3.1 Design the base relations. (10 Marks)

3.2 Design a representative of derived data by populating the fields in your relations with pseudo data in order to test the functionality of your database. (10 Marks)

3.3 Design general integrity constraints which depicts the rules governing the transactions represented in the scenarios. (10 Marks)

3.4 Design user views that were identified during the requirements collections from the scenarios. (10 Marks)

3.5 Design security mechanisms at system security level such as username and password, and data security by creating access rules using discretionary GRANT and REVOKE statements. (10 Marks)

Deliverable: To account for this exercise, you shall produce a document which contains fully labelled screenshots of your database relations, pseudo data for each relation, integrity constraints, user views and the security mechanisms designed for your database.

[Sub Total 50 Marks]

4. Advanced Query Processing

Now that you have implemented your database, part of your testing processes will be to analyse the performance of queries. As the Database Designer at BroadReach, recall that part of your responsibility is to carry out data analysis to identify critical interpretation of data that allows for the improvement of programme implementation and management. To demonstrate this competence, using the pseudo data in your database, you shall:

4.1 Create one cursor which allow the rows of a query result to be accessed one at a time. (10 Marks)

4.2 Create a stored procedure to confirm the reusability and maintainability of objects in your database. (10 Marks)

4.3 Create a function to show that your design is modular and extensible. (10 Marks)

4.4 Where logically justifiable in the scenarios above, create two triggers to define an action that the database should take when a certain event occurs in the application. (20 Marks)

Deliverable: To account for this exercise, you shall produce a document which contains fully labelled screenshots of your cursor, stored procedure, function, and triggers designed for your database.

5. Database Interface

Now that you have a fully functional database, you shall design and develop a third party application that interfaces with your database. Your interface may represent one or more user view from any of the scenarios above. Although preference is given to Java, you may use other languages of your choice.

Deliverable: To account for this exercise, you shall produce a document which contains fully labelled screenshots of your interface and your code. Please note that you are not allowed to use wireframing tools for your interface, you shall be penalised if you do so.

End of Assessment Tasks

Section B

Mark Allocation

Database Project Requirements	Allocated Marks
Deliverable 1	50
Deliverable 2	50
Deliverable 3	50
Deliverable 4	50
Deliverable 5	50
TOTAL	**250**

Section C

Plagiarism and Referencing

Pearson Institute of Higher Education places high importance on honesty in academic work submitted by students, and adopts a policy of zero tolerance on cheating and plagiarism. In academic writing, any source material e.g. journal articles, books, magazines, newspapers, reference material (dictionaries), online resources (websites, electronic journals or online newspaper articles), must be properly acknowledged. Failure to acknowledge such material is considered plagiarism; this is deemed an attempt to mislead and deceive the reader, and is unacceptable.

Pearson Institute of Higher Education adopts a zero tolerance policy on plagiarism, therefore, any submitted assessment that has been plagiarised will be subject to severe penalties. Students who are found guilty of plagiarism may be subject to disciplinary procedures and outcomes may include suspension from the institution or even expulsion. Therefore, students are strongly encouraged to familiarise themselves with referencing techniques for academic work. Students can access the PIHE Guide to Referencing on *my*LMS.

Negative Marking

Third-year Students

- A minimum of 15 additional information sources must be consulted and correctly cited.
- If no additional information sources have been used, a full 15% must be deducted.
- Deduct 1% per missing resource of the required 15. For example:
- If only five resources cited, deduct 10%.
- If only three resources cited, deduct 12%.
- Markers to apply the penalties for Category A for insufficient sources and incorrect referencing style.
- To determine the actual overall similarity percentage and plagiarism, markers must interpret the Turnitin Originality Report with reference to credible sources used and then apply the penalties as per the scale in the PIHE Policy for Intellectual Property, Copyright and Plagiarism Infringement.
- The similarity report alone is not an assessment of whether work has or has not been plagiarised. Careful examination of both the submitted paper/assignment/project and the suspect sources must be done.

Category A

Minimum reference requirements	Deduction of final mark
No additional information sources have been used or referenced.	15%