BMI Analysis System Phase 1: Design Document

Version 1.0

XYZZY Software

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Revision History

Version	Date	Author	Comments
1.0	01/07/18	D. Jarvis	Initial draft

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1. Introduction

XYZZY Software has been approached to develop a system to assist in the calculation and analysis of BMI (Body Mass Index) values. A phased implementation strategy will be adopted. This document represents the current state of the design for the Phase 1 system. Note that the system must be developed using Java Technologies (NetBeans, Swing, Java DB) and it must conform to the specification provided in this document.

2. Requirements

Because of the simplicity of the user requirements, the corresponding use cases are not duplicated here, as would be the case in a normal XYZZY design document.

The purpose of the system is to assist a health professional in the calculation and analysis of BMV values. A Java desktop application is to be developed, driven by a simple Swing GUI. Interaction between the database and the application is to be via JDBC. The NetBeans IDE is to be used for development. Java DB must be used as the database.

The initial user requirements are:

1. Start the application and connect to the database. If a connection cannot be established, the application must exit.
2. Close the database connection and stop the application
3. Display all records
4. Display all records where the BMI value is within a specified range
5. Calculate the BMI value and its corresponding category for all patients in the database and update all records.
6. The application must conform to the MVP (Model View Presenter) pattern.

The database design and sample data are provided in Section 4. Data validation is not required at this stage. However, basic preconditions must be satisfied for each requirement and if these are not satisfied, an appropriate message is to be displayed. These preconditions are specified in Section 8.

The BMI value is normally calculated as follows:

BMI = weight (in kgs) / (height (in metres))^2

The categorisation that is to be used is the following:

Range	Category
0.0-18.5	Underweight
18.5-25.0	Normal Weight
25.0-30.0	Overweight
30.0-35.0	Obesity (Class 1)
35.0-40.0	Obesity (Class 2)
40.0-100.0	Morbid Obesity

Table 1. BMI Categories for Adults

Note that BMI is a floating point number. For ease of comparison in database queries, BMI10, which is an integer quantity, is stored in the database. BMI10 is defined as integer defined as follows:

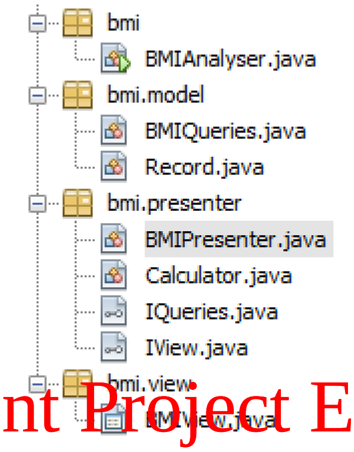
BMI10 = (int) ((BMI+0.05)*10.0) and

BMI = (double) ((BMI10/10 +(BMI10%10 / 10.0))

The user views and enters BMI values and not BMI10 values.

3. Architecture

A three-layered architecture conforming to the MVP pattern is to be employed in Phase 1. Given the simplicity of the architecture, an architecture diagram is not provided. Layers are to be modelled as packages – the package structure for the application is illustrated in Figure 1.



```
bmi
    BMIAnalyser.java
bmi.model
    BMIQueries.java
    Record.java
bmi.presenter
    BMIPresenter.java
    Calculator.java
    IQueries.java
    IView.java
bmi.view
    BMIView.java
```

Figure 1. Package structure

4. Database / Data Access Design

The SQL script that will be used to test the application is given below.

```
DROP TABLE RECORDS;

CREATE TABLE RECORDS

(

      SUBJECTID VARCHAR (8),

      HEIGHT REAL,

      WEIGHT REAL,

      BMI10 INT,

      BMICATEGORY VARCHAR (32),

      PRIMARY KEY (SUBJECTID)

);

INSERT INTO RECORDS(SUBJECTID,HEIGHT,WEIGHT,BMI10,BMICATEGORY)

      VALUES

      ('S01',1.8,70.0,0,'?'),

      ('S02',1.8,40.0,0,'?'),

      ('S03',1.8,100.0,0,'?'),

      ('S04',1.8,200.0,0,'?'),

      ('S05',1.8,81.0,0,'?'),

      ('S06',1.5,80.3,0,'?'),

      ('S07',1.5,59.9,0,'?'),

      ('S08',1.5,48.7,0,'?'),

      ('S09',1.5,48.3,0,'?'),

      ('S10',1.5,51.1,0,'?');
```

As there is only one table, an ERD is not provided.

Data access will be via JDBC using prepared statements. Normally, in an XYZZY design document, we would specify the queries in this section and relate them to the methods exposed by the BMIQueries class described in Section 6. However, for this project, we have decided to leave query formulation to the implementers.

5. GUI Design

Developers are free to use the NetBeans GUI Builder or alternatively, they can hand code the complete GUI. An indicative GUI is presented in Figure 2 and Table 2. Developers are free to use this design as is or to do things differently.

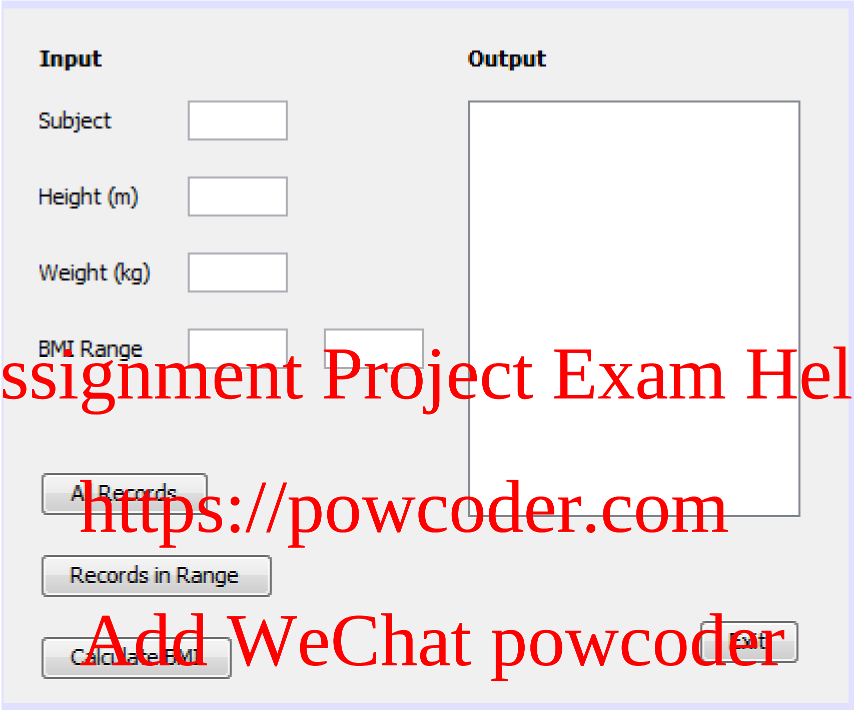
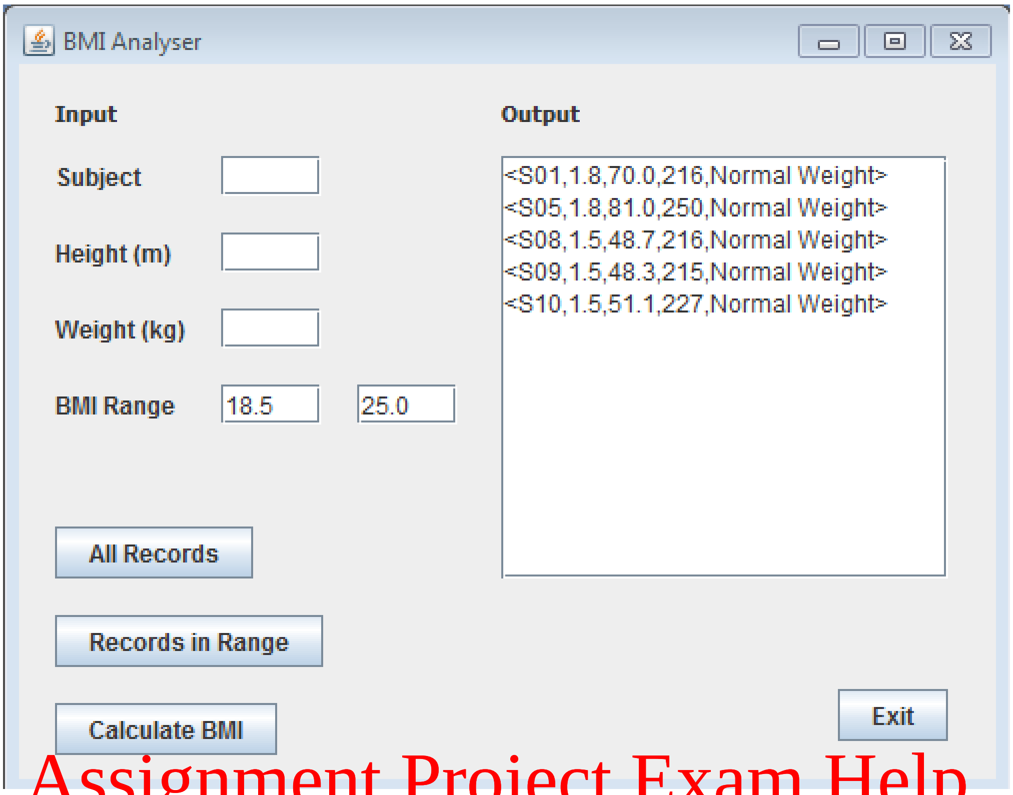


Figure 2. Indicative GUI

Functionality	Swing Components
Output	JTextArea
Input	JLabel, JTextField
Operations	JButton

Table 2. Mapping of GUI functionality to Swing component types.

When outputting results, formatting the data as tables with appropriate headings is not required – you can just use Record.toString() (appropriately formatted) to display the details of each result, as illustrated in Figure 3.



```
<S01,1.8,70.0,216,Normal Weight>
<S05,1.8,81.0,250,Normal Weight>
<S08,1.5,48.7,216,Normal Weight>
<S09,1.5,48.3,215,Normal Weight>
<S10,1.5,51.1,227,Normal Weight>
```

Figure 3. Output after Calculate BMI and Records in Range actions have been performed.

Note that because of the simplicity of the GUI in Figure 2, screen shots for the realisation of each requirement are not shown as would normally occur in an XYZZY design document. Rather, the required actions are summarised in Table 3.

Requirement	Button	Inputs Required
1	n/a	n/a
2	Exit	None
3	All Records	None
4	Records in Range	Range of BMI values – see below
5	Calculate BMI	None

Table 2. Mapping of requirements to actions

For Requirement 4, note that clicking of the Records in Range button will result in the invocation of a single method.

If two numbers are specified as input, then they are to be treated as the lower bound (left) and upper bound (right) of an inclusive range. Having the upper bound less than the lower bound is to be treated as an error. Having both numbers the same is not an error – they are the endpoints of a range of length zero.

If one number is specified, then if it is the right input, then the left input is set to 0.0. If it is the left input that is specified, then the right input is set to the value of the left input.

6. Class Diagram

The class diagram for the application is illustrated in Figure 4.

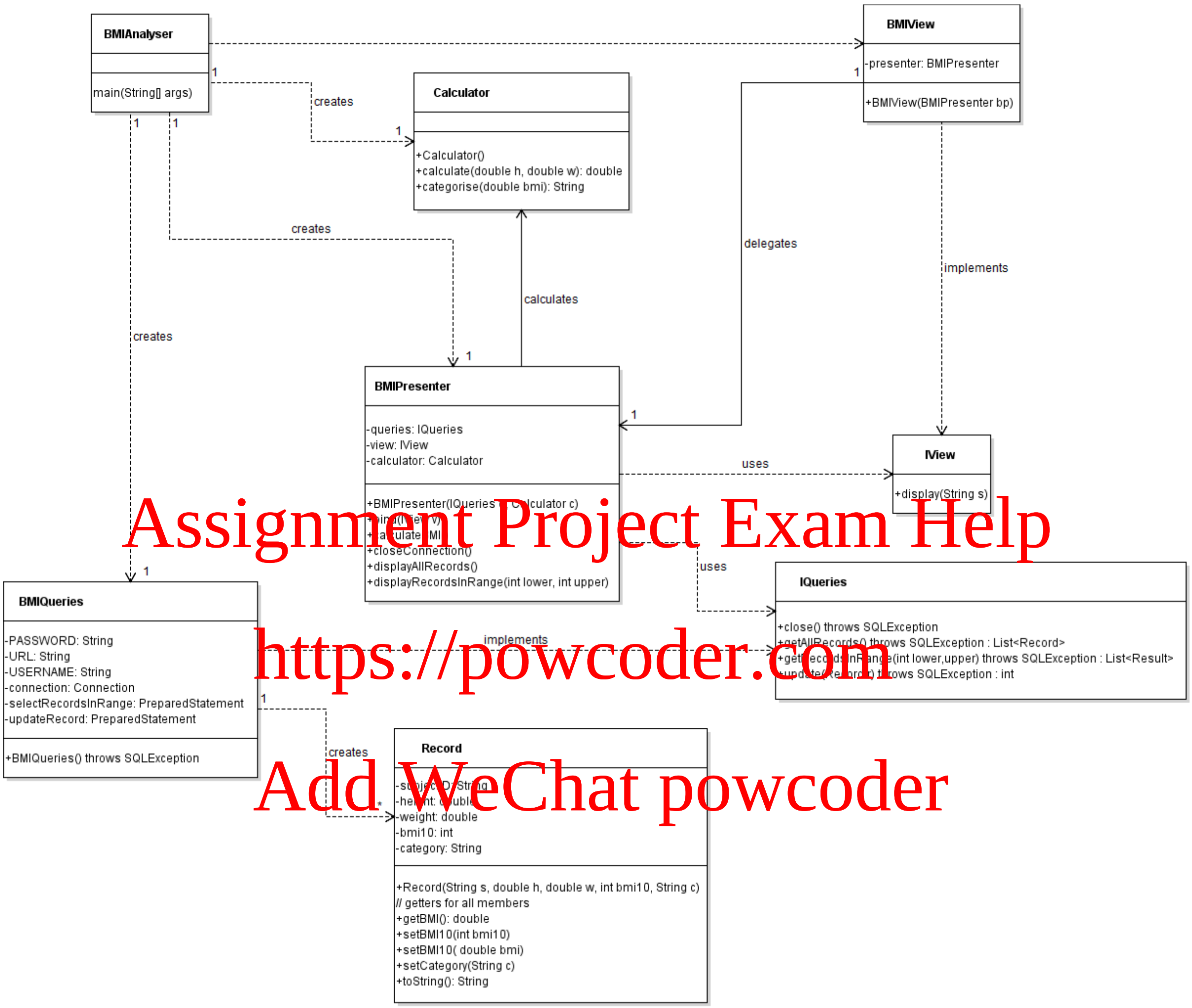


Figure 4. Class diagram

The mapping to packages/layers is provided in Section 3. Note that Figure 4 represents a refactoring of the class structure favoured by the NetBeans GUI Builder. Rather than having GUI creation in the GUI class definition (through the provision of a main() method, we have chosen to place GUI creation in a separate main class. If you are using the NetBeans GUI builder, all that this means is that the main() method that the Builder generates is moved into the BMIAnalyser class. Also note that interaction between the BMIQueries class and the JBC library classes is not shown, as is normal for class diagrams. Finally, formal UML syntax is not strictly followed. In particular, we feel felt that method signatures as employed in NetBeans are clearer than their UML counterparts.

In terms of implementation, note carefully where BMI10 (integer) values are used. As noted earlier, the user views and enters BMI (double) values with one decimal point of precision. With the Calculator class, no specific implementation approach is specified, but feel free to use an enum.

7. Sequence Diagrams

Omitted.

8. Test Plan

The following tests will be performed prior to acceptance:

Requirement	**Test**	**Comment**
1	Operation performs correctly given correct preconditions	
1	Handles no database/incorrect database	Application is to exit
2	Operation performs correctly	
3	Operation performs correctly	
4	Operation performs correctly given correct preconditions	No data validation checks required.
4	Handles incomplete field entry	
4	Input variants as specified in Section 5 are handled correctly	
5	Operation performs correctly	
6	Application is MVP conformant	Code inspection.

Table 3. Acceptance tests

Note:

1. By preconditions, we mean that the required values are available.
2. Acceptance tests coincide with class unit tests, so no separate unit testing is required.
3. Testing will be conducted with the database specified in Section 4.

Acknowledgements

The UML diagrams were created using Violet (http://horstmann.com/violet/)

In this assignment, you are to build a prototype for a BMI (Body Mass Index) management system according to the design document provided here. The system is to be implemented as a Java desktop application, with user interaction mediated by a simple Swing GUI. Reservations are to be stored in a Java DB database; Interaction between the database and the application is to be via JDBC. The system is to be developed using the NetBeans IDE.

Refer to the Unit Profile for assessment criteria. Note that these criteria apply to submissions that compile, run and conform to the specification provided in the design document. In particular note that to achieve full marks for this assignment, it is not sufficient to have an application that meets the designated functional requirements - the application must also conform to the design detailed in the design document and be appropriately implemented. Marks will be deducted for late submissions as per the CQU policy.

You are required to submit your completed NetBeans project as a zip file. You are not required to include the database that you use - markers will use their own copy of the database specified in the design document for marking purposes