

The Question Bank Project

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Introduction

We were tasked to create a quiz program for use by teachers and students to support revision for exams.

The program should allow teachers to create “quiz banks” associated to a module. Each quiz bank can contain multiple questions of different types. Students can use the program to take quizzes of their own selection where each quiz can contain some or all the questions in a question bank. The question and quiz data should be stored in text database.

I managed to complete all requirements and added in two new question types- multi choice questions and simple questions.

Use Case Diagram

From the requirements in the assignment, I created a use case diagram. I have two actors in my use case diagram: the teacher and student.

Some of the use cases are specific to one actor. Other use cases are applicable to the teacher and the student. It took several attempts before I was happy with the use case diagram.

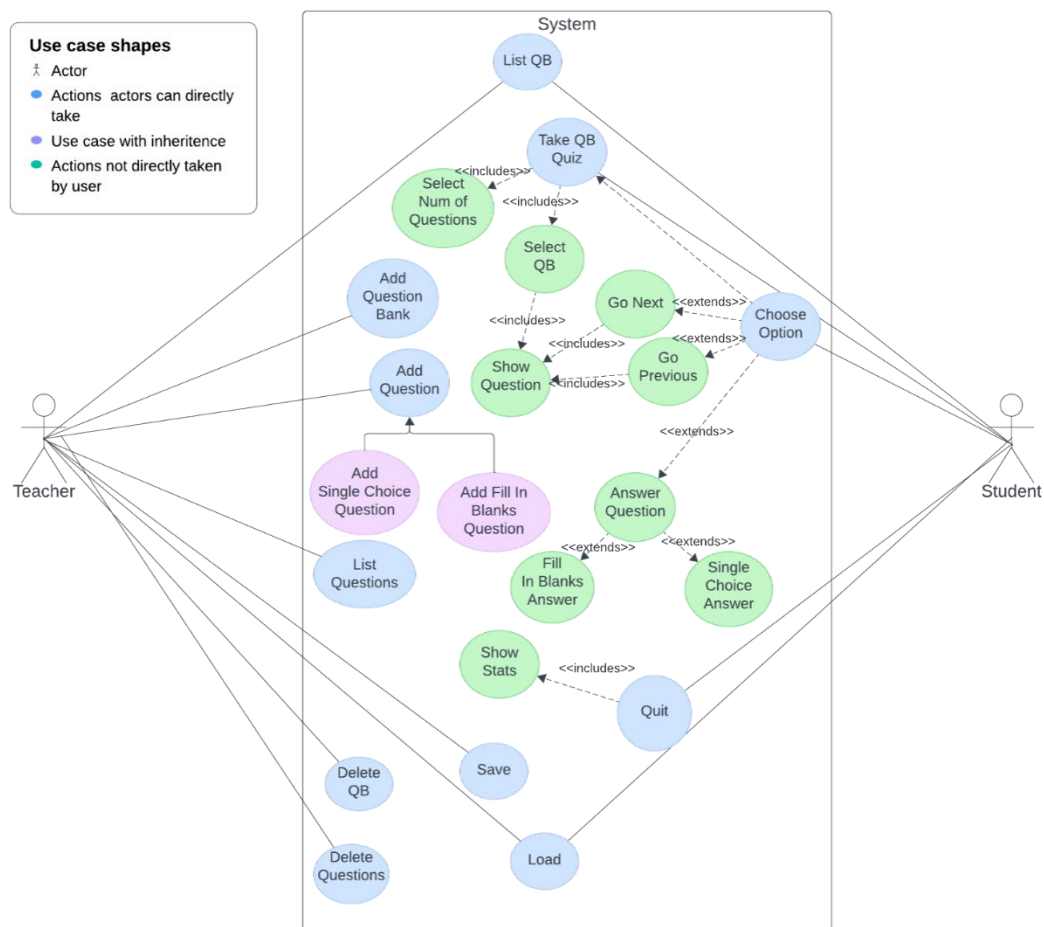


Figure 1 Final Use Case Diagram

Design

Class Diagram

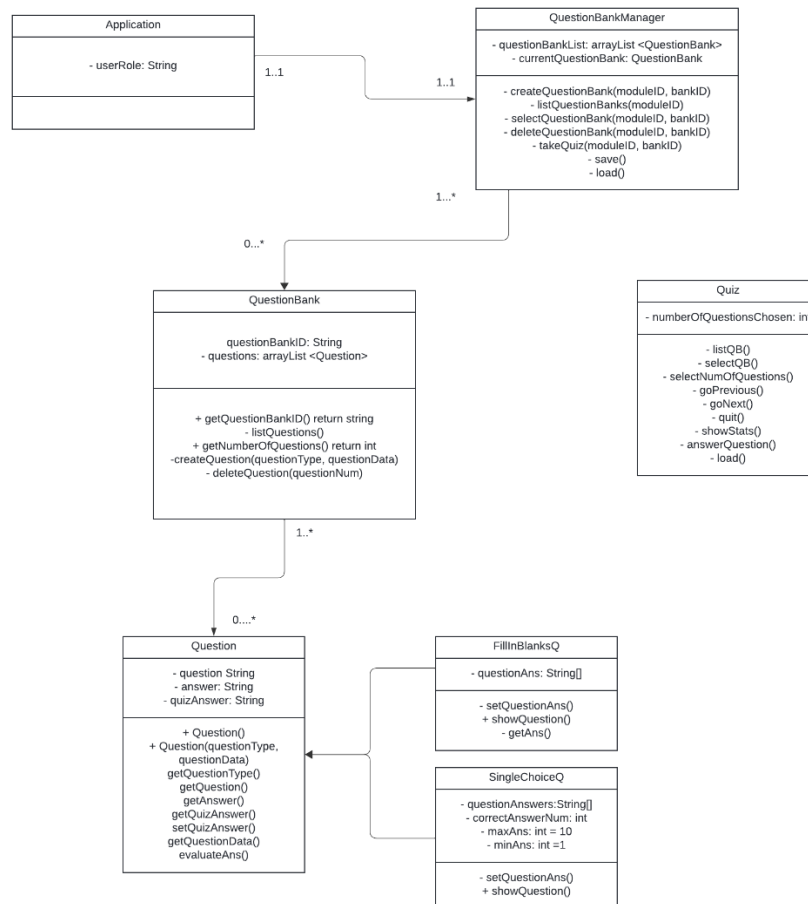


Figure 2 Initial Class Diagram

My initial class diagram is shown above however, I modified it several times after beginning to program. My final class diagram is shown below.

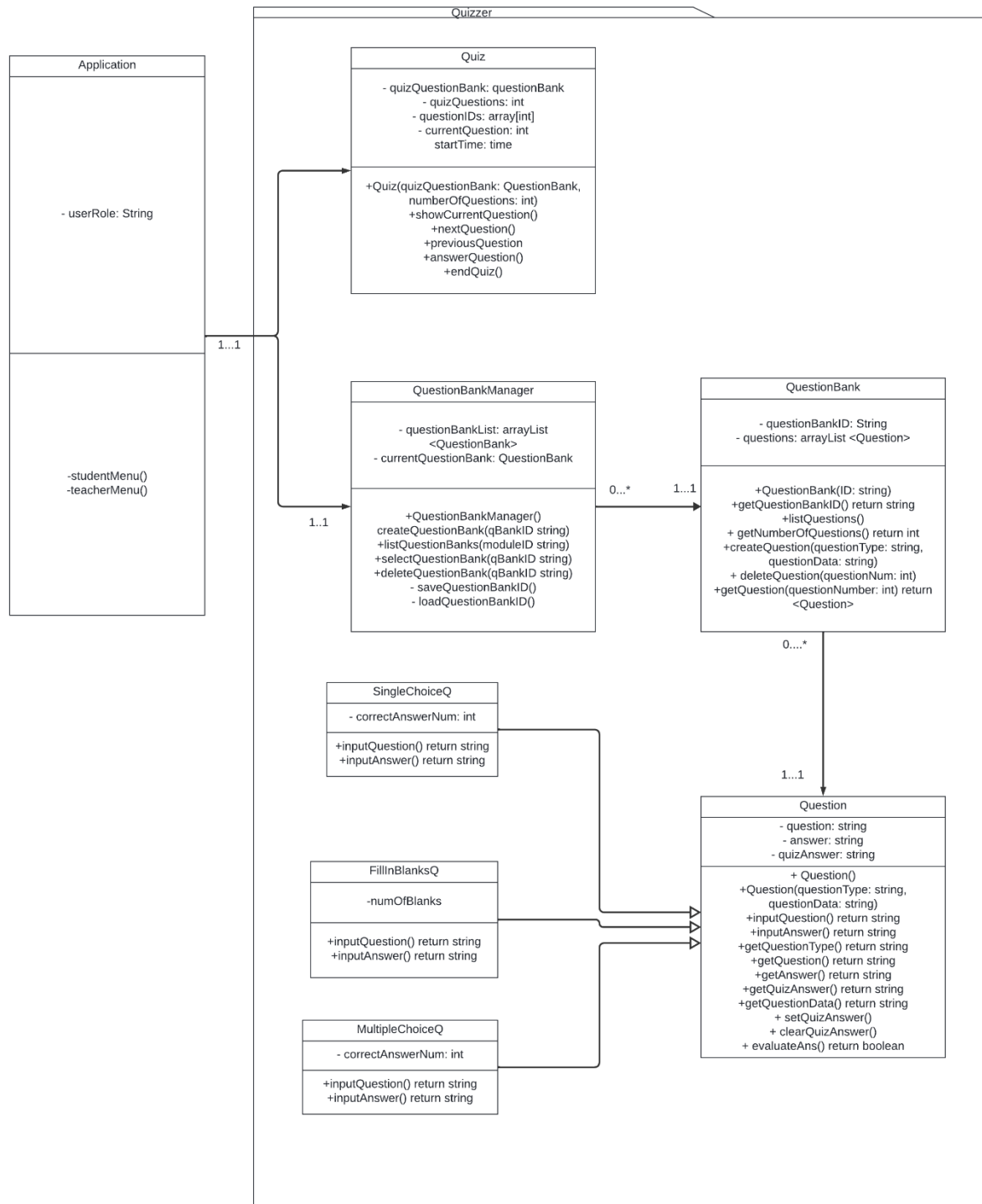


Figure 3 Final Use Case Diagram

Class Descriptions

Application

This is the main class where most functions in the Quizzer package are called from when the user selects commands from the menu. Application contains different menus for the teacher and student allowing them to do different things. It has a one-to-one relationship with the QuestionBankManager and Quiz classes which are described below.

Package Quizzer

I have created a package called Quizzer that contains all the classes that give the quiz program functionality. An external program interacts with the classes in Quizzer by calling the different methods. Some methods and variables are encapsulated to stop access from outside of the package.

QuestionBankManager

The QuestionBankManager class is responsible for managing all the instances of QuestionBanks and their questions e.g. createQuestionBank, selectQuestionBank, deleteQuestionBank. I used a manager class so the Application could be simple and just hold the menus. It also loads the question database db.txt in the constructor and saves it when quitting.

QuestionBank

This class holds all the methods for manipulating Questions (e.g. listQuestions(), deleteQuestion). QuestionBank has a zero to many relationship to Question as a question bank can exist without any questions and has no limit to the amount of questions it can have.

Question

Class Question holds an object capable of storing a “simple” question which is where a single question has one answer. It provides basic methods for inputting a question and answer either manually by the user or automatically when db.txt is loaded. It also has a field to store the student answer when the question is used in quiz. New question types can be created from Question using inheritance.

SingleChoiceQuestion

This class is a subtype of Question. It is different from Question because it allows the teacher to enter a question with multiple possible answers and one correct one.

MultipleChoiceQuestion

This class is a subtype of Question. It is different from Question because it allows the teacher to enter a question with multiple possible answers and multiple correct answers.

FillInBlanksQuestion

This class is a subtype of Question. It is different from Question because it allows the teacher to enter a question with blanks. The blanks are filled in when the teacher enters them but are then taken out of the question and stored as the answer.

Pseudocode

The hardest part of the code was to create QuestionBank and Question objects when loading the data from the data file db.txt. The file is written like this example:

MOD1:BANK1|0

MOD2:BANK1|3

SIMPLE|What colour is grass?|Green

SINGLE|What colour is the sky?[1]pink[2]blue[3]red|2|3

FILLIN|It's raining [1] and [2] today!!!|It's raining [cats] and [dogs] today!!!|2

MULTI|Which are primary colours?[1]pink[2]red[3]green[4]blue[5]yellow[6]gold|2, 4, 5|6

First there is a **module identifier** then a ":" then a **question bank identifier** then a "|" then the number of questions for that question bank. If there are questions for the question bank then these are on the next lines. Each question takes up a line. The first field is the **question type** followed by a "|" then the **question text**. After that is another "|" then the **answer text**. For single choice questions and multi choice questions there is another field that is the number of answer options. For fill in the blanks questions there is another field for the number of blanks.

open file f

if filenotfound error "File not found" exit.

while next line in f

 readln questionbankinformation from f

 moduleId = firstfield

 questionbankId = secondfield

 questionnum = thirdfield

 questionbank = new QuestionBank(moduleId, questionbankId)

 add questionbank to questionbanklist

 loop 0 to questionnum

 readln questioninformation from f

```
questiontype = firstfield
```

```
questiondata = secondfield
```

```
questionbank.createquestion(questiontype, questiondata)
```

```
end loop
```

```
end while
```


Testing

Checker = Has checker to see if input is valid

Most of the time **Checker** is used to check for “|” or “:” has been entered (as they are used as delimiters) or if the input is of the right type or out of limit or that it exists already.

ID	REQUIREMENT	DESCRIPTION	INPUT	EXPECTED OUTPUT	PASS /FAIL	COMMENTS
1.0 (NFR 2)		Student / teacher menu load	Q	File data is loaded into project. Filling up question and question bank arrays respectively. User is asked if they are a student or a teacher to which respective menu is launched	pass	Checker
1.1 (NFR 2)		TEACHER MENU	t	Teacher menu is loaded	Pass	Checker
1.1.1		Teacher can quiz menu	q	Message saying logging out and saving is displayed and all question bank and questions are saved into file	pass	
1.2 (NFR 2)		STUDENT MENU	S	Student menu is loaded	pass	Checker
1.2.1		Student can quiz menu	q	Message saying logging out is displayed	pass	Checker
A1	FR1	Teacher can create new empty question bank	MOD1:BANK1	The unique ID is added to the questionBank arraylist	Pass	New questionBank is added to the arraylist, can be seen when listing question banks
A2		Must be unique	MOD1:BANK1	An error message is displayed and user is sent back to menu	Pass	
A3		Bank ID must be of size 0-7	MODULUSONE:BANK1	Error message is displayed telling the user the MOD ID is too long and is prompted to input again	Pass	

A4		Bank ID must be of size 0-15	MOD1:BANK0 NEHUNDREDT HOUSAND	Error message is displayed telling the user the BANK ID is too long and is prompted to input again	Pass	
B0		Teacher can select Question bank to manipulate it	MOD1:BANK1	Message to confirm entered question bank is selected	Pass	Has an error catch if entered question bank doesn't exist
B1	FR2	Teacher can add new questions to existing QB	What colour is the sky? Blue	Question is added to arraylist questions of type SIMPLE	Pass	Can be seen when lists questions for question bank
B2		Check that the question bank exists	MOD1:BANK3	Has an error catch if entered question bank doesn't exist	Pass	
B3	FR2a	Single choice question	What colour is grass? Green Blue Pink 1	Teacher is prompted for question, answers one by one and then correct answer number. Question is added to arraylist questions of type SINGLE	Pass	Checker
B4		Single choice question: Number of answers is between 1 and 10	Numbers 1 to 10	The user should only be prompted for a max of 10 answers	pass	
B5	FR2b	Fill in the blanks question	It's raining [cats] and [dogs] outside!!	User is prompted for full text with the blanks filled. Question is added to arraylist questions of type FILLIN	Pass	The text inputted will be stored as the answer. And question text will be stored as inputted but with numbers replacing the blanks
B6		Checkers for the different input criteria	Brackets inside brackets, bracket doesn't have corresponding close / open bracket, No brackets inputted, Didn't use : or	User is told the issue and is reprompted	pass	

C1	FR3	Teacher can lists questions	b	All questions from selected question bank are listed	Pass	Checker
C2	FR3	Teacher can remove questions	e	question is removed from question bank	Pass	Can be seen when listing questions
D1	FR4	Teacher can list all question banks for specific module	l	User is asked for module id and then lists all question banks for it	Pass	Checker
E1	FR5	Teacher can delete empty question bank	D MOD1:BANK2	Empty question bank is removed from questionBank arraylist	Pass	Checker
E2		Teacher cannot delete a question bank that has questions	D MOD1:BANK1	Checks to see if there are any questions and displays error message	Pass	Checker
F1	FR6	Student can take quiz	t	Student is asked what question bank and how many questions to be displayed Quiz menu is displayed	Pass	Checker
F2	FR6a	Student can list question banks for module	l	student is asked for module id and then lists all question banks for it	pass	Checker
F3	FR6b	Asks for number of questions to be displayed	10	Amount of questions to be displayed is set to input		Number of questions is set to max is number entered is greater than total questions. Has checkers if 0 is entered, and if non integer is entered
F4	FR7	Student can end quiz and Stats are displayed	q	During the quiz if q is displayed, quiz is exited, stats are displayed and student menu is displayed,	pass	Stats displayed are totally number of questions answered, how many correct, how many unanswered, percentage, time taken

F5	FR8	Quiz questions are displayed in random order		Questions are displayed in a random order one at a time. Questions are displayed with what number out of total questions to be displayed, with current inputted answer	pass	Question 2 in data file is displayed as question 1
F6	FR9	Student can go to the previous question	p	Previous question is displayed	pass	Has checker if there are no previous questions
F6	FR9b	Student can go to the next question	N	Next question is displayed	pass	Has checker if there are no more questions
F7	FR10	Single choice question	Cats 3	Single choice question is displayed and if chosen to answer prompts student for correct answer number	pass	Has checker if non integer is entered, or if answer number is too high or too low
F8	FR10 b	Fill in the blanks question	Cats Dogs pigs	Question is displayed and prompts user to enter one by one for each blank	pass	Each blank is numbered
F9	NFR1	Question bank stored in a text based database		Store in a text file called dt.txt	pass	
F10	NFR3	New type of question: SIMPLE		Simple question is a single question has one answer	pass	Used as the base for questions
F11	NFR4	New type of question: MULTI		Multi question has one question to multiple potential answers to multiple answers	pass	

Running from the command line:

```
M:\ref17-individual-main-assignment-2023-24\QuestionBankProjectRef17\src>java Quizzer/Application
Loading in data...
Are you a teacher (t) or student (s)?
t

Welcome Teacher!

Please select from the following

'C' - To create a question bank
'L' - To list all question banks for a module
'S' - To select a question bank
'D' - To delete a question bank

'1' - To add a simple question for selected question bank
'2' - To add a single choice question for selected question bank
'3' - To add a fill in the blanks question for selected question bank
'4' - To add a multi choice question for selected question bank

'B' - List questions for selected question bank
'E' - Delete a question from selected question bank
'Q' - To quit and save
```

Screenshots from Testing

1.0:

```
Loading in data...
Are you a teacher (t) or student (s)?
t
```

```
Are you a teacher (t) or student (s)?
q
That was not an option
Please re-enter
```

1.1:

```
Are you a teacher (t) or student (s)?
t

Welcome Teacher!

Please select from the following

'C' - To create a question bank
'L' - To list all question banks for a module
'S' - To select a question bank
'D' - To delete a question bank

'1' - To add simple question for selected question bank
'2' - To add single choice question for selected question bank
'3' - To add fill in the blanks question for selected question bank

'B' - List questions for selected question bank
'E' - Delete a question from selected question bank
'Q' - To quit and save
```

1.1.1:

```
q
Logging out...
```

1.2:

```
Are you a teacher (t) or student (s)?
s

Welcome Student!

Please select from the following

'L' - To list all question banks for a module
'T' - To take a question bank quiz

'Q' - To quit
```

1.2.1:

```
q
Saving...
Logging out...
```

A1:

```
c
You have chosen to create a question bank
Please enter the question bank's unique ID
MOD1:BANK1
A question bank with the ID of MOD1:BANK1 has been added
```

A2:

```
c
You have chosen to create a question bank
Please enter the question bank's unique ID
MOD1:BANK1

This unique ID already exists
Sending you back to the menu...
```

A3:

```
C
You have chosen to create a question bank
Please enter the question bank's unique ID
MODULUSONE:BANK!
The module ID was too long, maximum limit of 7 chars
Try again
Please enter the question bank's unique ID
```

A4:

```
Please enter the question bank's unique ID
MOD1:BANKONEHUNDREDTHOUSAND1
The bank ID was too long, maximum limit of 15 chars
Try again
Please enter the question bank's unique ID
```

B0:

```
S
You have chosen to select a question bank
Please enter the question bank's unique ID
MOD1:BANK1
A question bank with the ID of MOD1:BANK1 has been selected
```

B1:

```
1
You have chosen to create a simple question
Enter question:
What colour is the sky?
Enter answer:
Blue
```

B2:

```
S
You have chosen to select a question bank
Please enter the question bank's unique ID
MOD1:BANK3
That is not a valid ID
Sending you back to the menu...
```

B3:

```
2
You have chosen to create a single choice question
Rules:
You are not allowed to use the '|' or ':'
Press enter with no input when you want to stop inputting answers
Enter question:
What colour is the sky?
Enter answer [1]:
green
Enter answer [2]:
blue
Enter answer [3]:
pink
Enter answer [4]:

There is no more answers inputted
Enter correct answer ID
1
```

B4:

```
Enter question:
What number comes after 9?
Enter answer [1]:
1
Enter answer [2]:
2
Enter answer [3]:
3
Enter answer [4]:
4
Enter answer [5]:
5
Enter answer [6]:
6
Enter answer [7]:
7
Enter answer [8]:
8
Enter answer [9]:
9
Enter answer [10]:
10
Enter correct answer ID
10
```

B5:

```
3
You have chosen to create a fill in the blanks question
Enter your text where the blanks to be filled in are in square brackets
It's raining [cats] and [dogs] outside!!
```

B6:


```
You have chosen to create a fill in the blanks question
Enter your text where the blanks to be filled in are in square brackets
one bracket [
Every open bracket needs a close bracket, and every close bracket need an open bracket
Enter your text where the blanks to be filled in are in square brackets
close bracket ]
Every open bracket needs a close bracket, and every close bracket need an open bracket
Enter your text where the blanks to be filled in are in square brackets
bracket inside bracket [[]]
You are not allowed [] inside of []
Every open bracket needs a close bracket, and every close bracket need an open bracket
Enter your text where the blanks to be filled in are in square brackets
: entered
You are not allowed to use the character ':'
Try again...
You have entered no brackets
Please use brackets to indicate where the blanks are
Enter your text where the blanks to be filled in are in square brackets
| entered
You are not allowed to use the character '|'
Try again...
You have entered no brackets
Please use brackets to indicate where the blanks are
Enter your text where the blanks to be filled in are in square brackets
```

C1:

```
b
You have chosen to list questions
1: What is colour is grass?
2: What colour is the sky?[1]pink[2]green[3]red
3: It's raining [1] and [2] and [3] out here!
```

C2:

```
e
You have chosen to delete a question
Enter the question number you want to delete
1
You have removed question 1
```

D1:

```
l
You have chosen to list all question banks for a module
Please enter the module ID
MOD1
BANK1
BANK2
```

E1:

```
d
You have chosen to delete a question bank
Please enter the question bank's unique ID
MOD1:BANK2
A question bank with the ID of MOD1:BANK2 has been deleted
```

E2:

```
d
You have chosen to delete a question bank
Please enter the question bank's unique ID
MOD1:BANK1
This question bank still has questions...
You must delete all questions before deleting the question bank.
```

F1:

```
t
You have chosen to take a quiz
Please enter the question bank's unique ID
MOD:BANK
A question bank with the ID of MOD:BANK has been selected
```

F2:

```
l
You have chosen to list all question banks for a module
Please enter the module ID
MOD1
BANK1
BANK2
```

F3:

```
A question bank with the ID of MOD:BANK has been selected
How many questions would you like?
```

```
0
```

```
The number of questions must be greater than 0
How many questions would you like?
```

```
1
```

```
How many questions would you like?
```

```
s
```

```
Please enter an integer
```

```
How many questions would you like?
```

```
10
```

```
Number of questions set to 3 - the maximum number in selected question bank
```

F4:

```
'Q' - to quiz the quiz
```

```
q
```

```
Quitting quiz...
```

```
STATS...
```

```
You entered 2 questions out of 3
```

```
Questions unanswered: 1
```

```
You answered 2 questions correctly
```

```
You got a percentage of: 67%
```

```
Duration: 0 hours and 0 minutes and 39 seconds
```

F5:

```
Question 1 out of 3
```

```
What colour is the sky?[1]pink[2]green[3]red
```

```
Your answer: 3
```

F6:

```
Please select from the following:
```

```
'A' - to answer current question
```

```
'N' - to go to the next question
```

```
'P' - to go to the previous question
```

```
'Q' - to quiz the quiz
```

F7:

```
Question 1 out of 3
What colour is the sky?[1]pink[2]green[3]red
Your answer: 3

Please select from the following:

'A' - to answer current question
'N' - to go to the next question
'P' - to go to the previous question

'Q' - to quiz the quiz
```

```
Enter correct answer ID
cats
That is not an integer
Enter correct answer ID
3|
```

```
Enter correct answer ID
11
That is not a valid answer option, options stop at: 3
Try again...
Enter correct answer ID
0
0 is not an option, answer IDs start from 1
```

F8:

```
Question 2 out of 3
It's raining [1] and [2] and [3] out here!
Question unanswered

Please select from the following:

'A' - to answer current question
'N' - to go to the next question
'P' - to go to the previous question

'Q' - to quiz the quiz
a
Answer 1:
cats
Answer 2:
dogs
Answer 3:
pigs
```

F9:

```
MOD:BANK|5
SIMPLE|What is colour is grass?|Green
SINGLE|What colour is the sky?[1]pink[2]green[3]red|3|3
FILLIN|It's raining [1] and [2] and [3] out here!|It's raining [cats] and [dogs] and [pigs] out here!|3
MULTI|Which are primary colours?[1]pink[2]red[3]green[4]blue[5]yellow[6]gold|[2, 4, 5]|6
```

F10:

```
Enter answer:
green

Question 2 out of 3
What is colour is grass?
Your answer: green
```

F11:

```
a
Press enter with no input when you want to stop inputting answers
Enter a correct answer ID one by one
2
Enter a correct answer ID one by one
4
Enter a correct answer ID one by one
5
Enter a correct answer ID one by one

There is no more answers inputted

Question 3 out of 4
Which are primary colours?[1]pink[2]red[3]green[4]blue[5]yellow[6]gold
Your answer: [2, 4, 5]
```

Evaluation

How I went about solving the assignment:

To solve this assignment, I put a lot of work into my diagrams (Use Case and Class) and rough class descriptions and used them as my main reference when I started programming. However, I had to keep reshaping them as I noticed issues such as repeated code.

I also thought a lot about how my text file (db.txt) would look and how to load and save it. It helped to reference back to slides / worksheets (Monsters) for tricky functions like this.

For a couple of the more complex functions like the file loading and making the quiz it helped to make basic pseudocode.

What flair, if any, was attempted?

I used inheritance to make subtypes of Question where the superclass worked as a simple type question. From this I could easily create other question types from that class using inheritance which I did twice. I put all the quiz related code into a package to help section code.

What I found difficult.

I found keeping everything encapsulated a challenge, making sure that each class only referenced / knew about what it should. I used a separate Application class to call the methods from menu commands entered by the teacher or student from the package. I found using constructors with inheritance difficult because the inherited classes kept calling the superclass class constructor inside of its constructor.

What remains to be done.

I completed all the requirements to make a working program.

What did I learn?

I learnt that all the checkers in the world is never enough, even for something like this program that looks simple there seems to be lots and lots of things to be checked to make sure that the program runs and doesn't crash.

I learnt to be more efficient with my code. A lot of what I wrote at first was duplicated so I kept making them into functions that could be reused.

I learnt how constructors called from subclass to super class works. I learned that although you expect to call enter the subclass constructor it also then loads and runs the super class constructor. This caused problems. In the end I had an empty superclass constructor that did nothing. This worked because I wanted my Question constructors to have parameters, making it different from the

no parameterised constructor. Once this worked though easy and fun to use inheritance to make different questions.

I learnt that testing is difficult and takes much longer than expected and often will find bugs you never knew existed.

What mark do I think I should be awarded and why.

Overall, I think my program is of high quality (e.g. object oriented and following principles such as high cohesion and low coupling, good identifier names, indentation, small methods, java doc commenting, error checking and exceptions, reading and writing a file) and would only improve it by adding more error checking or a graphical user interface for controlling the program or adding more question types.

Therefore, I would mark myself 72%.

Brief description of any creativity and innovations I have done in my implementation.

The part I was most proud of is my extra two question types that I added, sectioning my classes by using a package and all the checkers I implemented so the user knew what went wrong.