

Comments Please see attached.

COMP23420 Exam Performance Feedback 2015

Questions in plain font, answers in **bold**, additional comments in *bold italic*.

General comments:

LZ: This year a total of 204 students enrolled in this course and 197 of them attended the exam. Performance on my questions seems to be better than last year's. Specifically, performance on Question 2 (2.1 or 2.2) is better than Question 1 (a - e). Most of my questions for this year are simple, bookwork questions and their answers can be found in my lecture notes. Overall, my marking is very generous, perhaps too generous, but the students have also revised very well as some of them copied the answers word by word from my lecture notes.

JS: Likewise I was pleasantly surprised, given how few students attended the lectures.

Question 1 (Answer All Questions)

- a) What is a software development process? Why do we need software development processes?

(2 marks)

A software process is a structured set of activities for specifying, designing, implementing and testing a software system [1m]

Successful software engineering projects show: (1) good software development processes lead to good software and (2) good processes reduce risk [1m]

LZ: This is a bookwork question based on week 2's lecture notes, but only about half of the answers were correct.

Common mistake 1: Answers gave a circular definition: a software process is a process of software development.

Common mistake 2: Answers failed to spell out what activities are involved in a software process.

Common mistake 3: The second part of the question was left out unanswered.

- b) Briefly describe the incremental software development process.

(2 marks)

The incremental development process consists of four stages:

- Decompose the development and delivery into increments with each increment delivering part of the required functionality [0.5m]
- Prioritise user requirements and include the highest priority requirements in early increments [0.5m]
- Freeze the requirements once the development of an increment is started [0.5m]
- Continue to evolve the requirements for later increments [0.5m]

LZ: This is a bookwork question based on week 2's lecture notes, but only a small number of students answered this question fully and correctly.

Common mistakes: Most answers contained a statement similar to this: "The incremental development process is a step-by-step development process", but failed to spell out what these steps were.

- c) Briefly explain the four reasons for measuring software.

(2 marks)

Four reasons, 0.5m each:

- Determine the quality of the current product or process
- Predict quality of a product/process
- Improve quality of a product/process
- Estimate software development cost and effort

This is a bookwork question based on week 9's lecture notes. Half of the answers were correct. A common mistake was that the answer omitted the last reason.

LZ: This is a bookwork question based on week 9's lecture notes. Half of the answers were correct. A common mistake was that the answer omitted the last reason.

- d) What is the role of a software engineer?

(2 marks)

To understand the user needs and requirements, and how the system-to-be interacts with the user and the environment [1m]; to design the system-to-be based on this understanding [1m].

LZ: This is a bookwork question based on week 2's lecture notes. Most answers were correct, but quite a significant number of answers omitted the first half of the answer.

- e) Explain this statement: "Lines of code are a poor indicator of software productivity."

(2 marks)

Because such an indicator:

- Ignores software reuse, code duplication, benefits of redesign [1m]
- It is misleading: The lower level the language, the more productive the programmer [1m]
- Or the more verbose the programmer, the higher the productivity [1m]

LZ: This is a bookwork question based on week 9's lecture notes. This question was generally answered well.

f). Explain in terms of cohesion and coupling whether in the IBMS scenario of your team project it would have been a good idea to have a single class which integrates the roster and the driver timetables it produces. You should consider both kinds of coupling mentioned in the lectures. (2 marks)

No because: Such a class would not be cohesive, as a driver timetable is a well-defined entity in itself and should be a separate class. [1] It would have high *external* coupling, as the rest of the system depends on the roster. In terms of *internal* coupling, although there is only one class, but inside that class there would be a lot of messy coupling as it's really two classes. [1]

JS: Most people got the right general idea, and in particular the mark about cohesion. On coupling some people said internal was bad but not internal, some the other way round, and some correctly recognised that both would be bad. The few people who thought it was a good idea are not destined for a career in SW development.

g). What would be a sensible class structure for the roster and the driver timetables it produces? (2 marks)

Obviously they should be clearly separated. The rest of the answer depends on what they actually did, or on coming up with good ideas in the exam but having a weekly roster composed of daily ones is sensible, and likewise for the timetables. A class diagram is ok as answer to this question.

JS: Answers to this were terrible. Almost nobody recognised that dividing the Roster and driver timetable classes is just a starting point; The Roster is a huge class and needs dividing up. [Note: the more experienced an OO designer is, the smaller their classes tend to be]. Fortunately, the remaining parts of the question were very well answered, so overall most people got 7 or more out of 10.

h). What is the key idea of Test-Driven Development (TDD) and how did you apply TDD in your IBMS implementation? (2 marks)

You write the tests *before* the code. [1] Marks for any sensible answer to the second part [1] (they were advised in a lecture they should experiment with this).

JS Most people knew what TDD is, and most claimed to have used it in the lab. Although I was sceptical about many of these claims, they got the mark, as did those people who said they'd tried it and found it too difficult.

i). Explain why a programmer testing their own code is often not appropriate, and a traditional method (not TDD) for overcoming this. (2 marks)

A programmer may (consciously or unconsciously) assume their code will work, and not test it to fail sufficiently. [1]. The traditional solution to this is to have a separate testing team, whose job is to be as nasty to the software as possible. [1]

JS. Most people got the first point. I also accepted pair programming as an answer to the second point, but not just a vague "somebody else"

j). State two advantages of TDD over traditional testing. (2 marks)

Any two of: It dissuades you from adding features just for the sake of it; it helps to clarify requirements; it guarantees good test coverage, and so removes many bugs early or other sensible points.

JS. Most people got two of the above or other valid points. To know more, I strongly recommend you do the Agile course in the third year.

Question 2

Answer Either Question 2.1 or 2.2

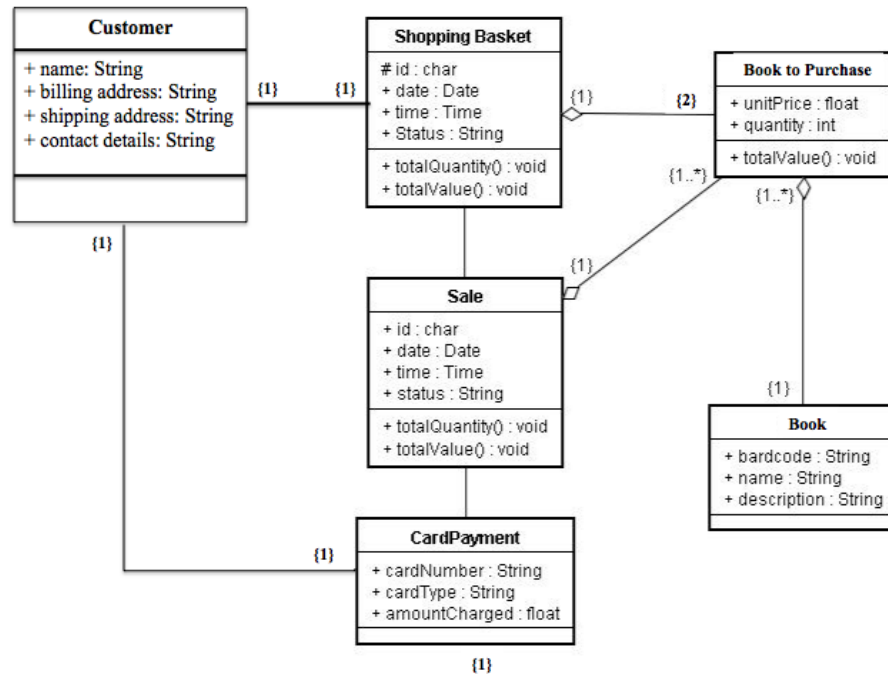
2.1: Consider this scenario for an online retailer: "After placing two books in a shopping basket, the customer proceeded to checkout and made the payment by using a credit card."

LZ: Less than a half of the students (73 out of 197) have chosen this question. The performance was generally good on this question.

a) Draw a domain model of this scenario by using a UML class diagram.

(6 marks)

A good domain model should be similar to this one:



- Show correct classes [2m]
- Show correct relationships [1m]
- Show correct multiplicities [2m]
- Show key attributes [1m]

LZ: This is a very simple application question based on week 3's lecture. A similar domain model was given in that week's lecture, together with detailed guidelines on how to construct a domain model. Before that lecture, the students had already spent the entire semester 1 on UML modelling, so my expectation was this should be a very easy question for all the students. The question was a bit of a giveaway in my view. However, a variety of answers were given and no one got the model 100% correct.

Common mistakes: (1) don't know how to draw a UML class diagram; (2) don't know how to translate the given scenario into a UML class diagram; (3) mix UML class diagram with Use Case diagram; (4) simply copy the model given in week 3's lecture without even changing the names of the classes; (5) missing attributes.

- b) Explain the relationships between the domain classes and the meaning of the multiplicities on the relationships.

(4 marks)

The customer uses (is associated with) a shopping basket 1:1 and the customer makes the card payment (is associated with) a payment 1:1 [1m]

The shopping basket contains 2 books to purchase 1:1 [1m]

A book can be purchased by more than one customer and hence can be contained in more than one Book to Purchase 1: 1..* [1m]

Each sale is associated with exactly one shopping basket and one payment 1:1 [1m]

LZ: Most answers were incorrect. Common mistakes: Don't know the kinds of relationship between classes and the multiplicities of the relationships. In general, most students have not mastered the UML class diagram.

Overall, in spite of semester 1's teaching on UML modelling and my detailed lecture notes on how to draw a domain model, the answers show that most of the students still cannot draw a simple UML class diagram. This is further evidenced by the fact that less than half of the students chose this question.

2.2. Answer the following questions:

More than half of the students (127 out of 197) have chosen this question.

- a) What type of architecture does your IBMS system have? Briefly describe its main components.

(2 marks)

It is a layered architecture consisting of an UI layer, a business logic layer, a database connector layer, and a database. [0.5m each layer]

LZ: This is a bookwork/application question based on week 1's lecture notes. This question also appeared in a previous year's exam paper and most answers then were correct. But this year was different. In week 1's lecture, I stressed that this architecture was given to the students for their team projects and they must use this architecture. Yet, a significant number of answers stated that the architecture was a MVC and a small number (about 2 to 3) answers stated the architecture was an object-oriented programming. This is really very disappointing. Only if those students studied a little harder and revised the lecture notes a little harder, they would have got the marks easily for this question.

- b) What is a domain model? What is the role of a domain model in software development?

(2 marks)

A domain model is an abstract representation of a software development problem [1m].

The role of a domain model is to show “real world” domain classes and their relationships and use them to identify software classes in the design model [1m].

LZ: This is a bookwork question based on week 3’s lecture notes. Most answers were correct. A small number of answers either didn’t know that a domain model represents a software development problem or didn’t know that the purpose of a domain model was to provide a basis for identifying design classes

- c) What is a “Pure Fabrication”? Why do we need Pure Fabrications? State an example that uses a Pure Fabrication in software design.

(3 marks)

A Pure Fabrication is a design class, which does not correspond to anything in the domain [1m]

We need PFs to represent software objects that are missing in the domain model [1m]

Examples [1m]

- Collections
- Interfaces to external systems, e.g. database connectors
- Factories – classes whose sole job is to create objects of other classes.
- UI components
- Indirections to, and abstractions of, other classes.

LZ This is a bookwork question based on week 3’s lecture notes. Most answers were correct.

- d) Function points can be used to measure the functionality offered by a system. Explain how to calculate a function point count for a system.

(3 marks)

Based on four program characteristics [1m]:

- external inputs and outputs
- user interactions
- external interfaces
- files used by the system

Assign a weight to each of these characteristics [1m]

The function point count is computed by multiplying each raw count by the weight and summing all values [1m].

LZ: This is a bookwork question based on week 9’s lecture notes. This should have been a straightforward question. However, I accidentally edited the relevant slide off the lecture notes just before week 9 when I was refining the slides. After reporting this error to the

teaching director, the school is to deal with question 2.2 in a best possible way to be fair to all students.

Question 3

Answer All Questions

- a). Briefly explain the role of GRASP patterns in object-oriented software development. (2 marks)

A good answer is

They provide a set of principles for assigning responsibilities to classes, the most difficult skill in OO software development.

+ one other good point, e.g. Like all patterns they form a language which helps developers to communicate They provide guidance on when to refactor and how.

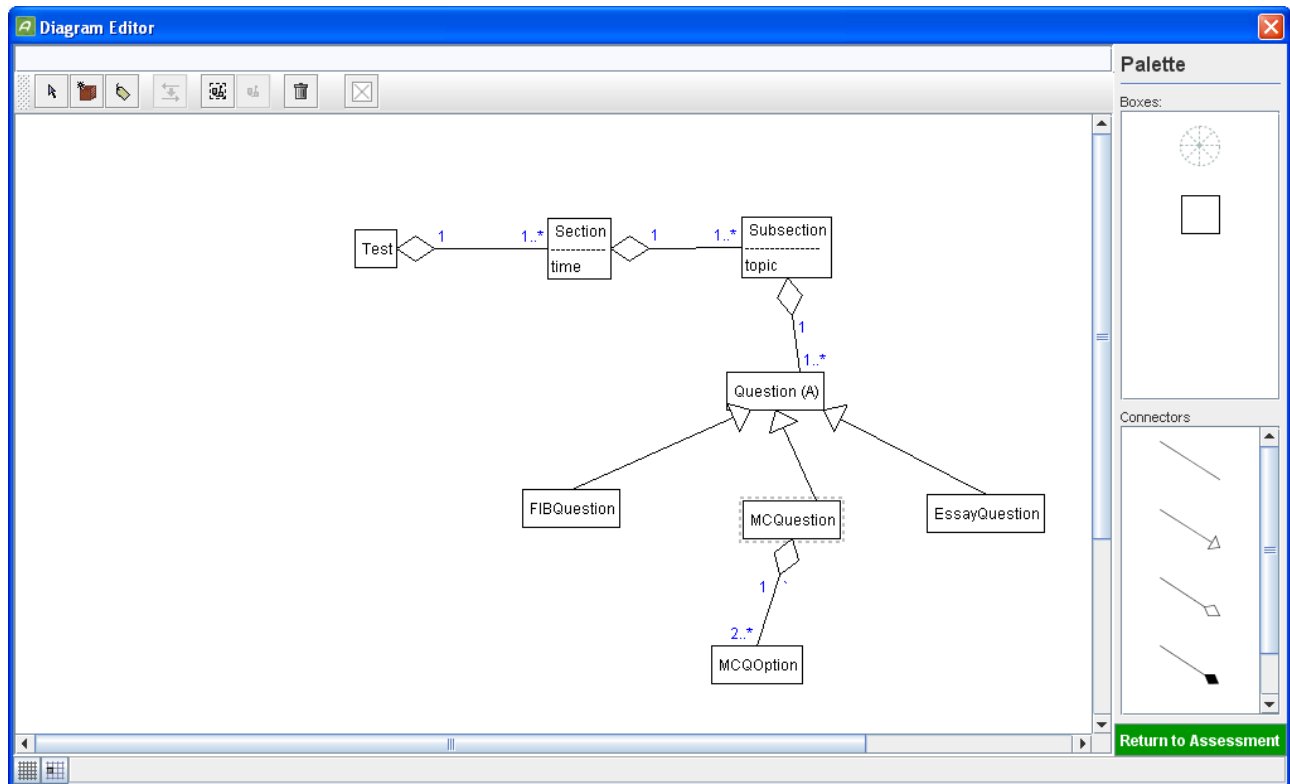
Answers with examples are also good.

JS:Most answers were good.

- b). You are designing a system to test students in English language skills in order to find people who need to take remedial English classes. You have elicited the following requirements about the structure of the tests.

A test consists of one or more sections, each of which is timed separately. Each section contains one or more subsections, each of which is on a particular topic. Each subsection contains one or more questions. Questions are of three different types: multiple choice questions, “fill in the blank” (FIB) questions and essay questions. Multiple choice questions have two or more options.

Draw a class diagram which BOTH captures all and only the information given in the above description AND leads directly to a design which adheres to GRASP principles. (6 marks)



Acceptable variations: different names for the types of question (provided they are appropriate singular nouns); using a plain line marked “contains” or similar instead of the diamond. For answers of the overall right shape deduct 1 mark for each of

- Additional classes or attributes not mentioned in the description (or operations). Or any other extraneous clutter
- Missing classes or attributes.
- Abuse of UML notation
- Inappropriate names (e.g. “Sections” rather than “Section”)

Award max 2 for completely different solutions.

JS: I have to echo Liping’s remarks about UML diagrams. Only a handful were fully correct, even after I ignored use of the black diamond, since this was overused in the first semester. As far as I can figure out, the black diamond was introduced at a time when primitive languages without GC, like C++ were widely used. The black diamond essentially means that when you delete the contained (sections, questions etc.) you can delete the container. This is not appropriate here, e.g. often you want to set up the overall structure for an exam and add the specific questions later. But anyway I ignored that kind of error when I was marking, but there were many others, mostly falling into the categories predicted above.

In particular a number of answers were grossly cluttered, even including answers in the question classes!! (They should be a whole separate class hierarchy not attached to the questions, and physically stored separately)

A number of people proudly proclaimed that this was the Composite design pattern which it is not. Composite allows you to have an arbitrary number of levels: here it is fixed at three

Technical note: there's an interesting tradeoff here. Just one level, as in BB, is obviously no good as you can't have structured assessments. Using Composite, as in ABC, allows any structure you like, but inexperienced users find it confusing. Three levels might therefore be a good tradeoff.

d). Suggest two pure fabrications (other than UI classes) which could be added to the domain-inspired classes to help complete the design.

(2 marks)

e.g. if the questions are stored in a database we will need a database connector to get them; [1] we could generate questions from a factory (given a topic get a subset of the questions available on that topic).[1] Marks for anything sensible.

JS: Some answers were good, many citing the two examples given above. Others did not recognise that this cannot be a complete domain model for the application, and that there therefore must be many other domain classes. In particular, the fact that sections are timed individually means there must be a Timer domain class.