This question paper consists of 4 printed pages, each of which is identified by the Code Number COMP293101.

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School of Computing

January 2018

COMP2931

Software Engineering

Answer all three questions

Time allowed: 2 hours

Question 1

A project manager briefs his team of developers about a project as follows:

"I've done the planning. For the first two weeks, we'll be gathering requirements. Then we'll spend two weeks writing the requirements specification for the client. If they give the OK to proceed, we'll spend a month on developing the high-level architecture and writing a detailed design document, then three months on implementing all the features. For the last month, we'll be almost exclusively focused on testing. I've allowed a week at the end in case we overrun.

I'll be expecting detailed UML diagrams for the requirements specification and the design document, drawn using Microsoft Visio. I'll be drafting both documents using Microsoft Word and I will circulate them via email so you can add your contributions."

(a) What kind of development process is the manager describing in the first paragraph, and what is its principal weakness? **[2 marks]**

(b) Describe how you might change the process described in the first paragraph in order to improve the chances of a successful outcome and maximise the return on investment for the client. **[8 marks]**

(c) Consider this manager's approach to time estimation, rather than the time estimates themselves. Comment critically on the approach he has followed. Outline a better way of doing this. **[5 marks]**

(d) The manager appears to be advocating the creation of detailed documentation and diagrams as part of capturing requirements and producing a viable design. Why might this not be a good use of time? What could be done to improve how information on requirements and design is managed? **[5 marks]**

[Question 1 total: 20 marks]

Question 2

(a) The `Card` class represents a playing card, like that shown below.
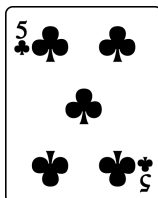
The `CardCollection` class represents a collection of cards. It has a method `add`, which adds a card to the collection. The `PokerHand` class is a kind of card collection that knows some of the rules of the game of Poker. It has a method called `isFlush` that returns `true` if the hand of cards is a 'Flush' (all cards of the same suit—e.g., all Clubs, like the card shown above).

Draw the UML class diagram implied by the statements above. **[8 marks]**

(b) A system has a feature in which data are downloaded from a web site using HTTP and then stored in an SQL database. The developer shows you the unit tests he has written for this system. One of them tests downloading by creating a socket and interacting with a server on the internet. The other performs an SQL update against a locally-running instance of MySQL, followed by a query to check that the data have been stored correctly.

Explain why these should not be regarded as good unit tests. Suggest improvements that could be made so they will work better as unit tests. **[5 marks]**

(c) Suppose you are developing a class called `Dataset`, which stores a collection of `int` values. The class has a default constructor and an `add` method with a single `int` parameter, representing a value to be added to the dataset. The class also has a method called `minimum`, which returns the minimum of the values in the dataset. This method should throw an instance of exception class `DataException` if the dataset is empty.

Write down the code for two JUnit test methods that, together, would be suitable for testing `minimum`. **[7 marks]**

[Question 2 total: 20 marks]

Question 3

(a) A first-year student has some basic familiarity with the Git version control system, but only as solo developer. She is interested in how she would have to use Git when she does her team project in the second year.

Write a short note to this student explaining how she and her fellow team members could make effective use of Git in their project. **[6 marks]**

(b) When developing in teams, why is it considered essential to have an automated build process, managed by version-controlled build scripts? **[4 marks]**

(c) Suggest two reasons why a Java project might be better off using Gradle as a build system, instead of Ant. **[2 marks]**

(d) A team decides to adopt pair programming, test-driven development and refactoring as standard working practices, with the aim of improving code quality. They expect that this will slow them down, but discover instead that they are delivering solutions as quickly as they did before, but with fewer defects.

Explain how these techniques work in concert with each other to improve code quality, and why all the apparent extra work has not slowed the team down. **[8 marks]**

[Question 3 total: 20 marks]

[Grand total: 60 marks]