University of St Andrews

DECEMBER 2017 EXAMINATION DIET

SCHOOL OF COMPUTER SCIENCE

MODULE CODE: **CS5030**

MODULE TITLE: Software Engineering Principles

EXAM DURATION: 2 hours

EXAM INSTRUCTIONS: (a) Answer **three** questions.
(b) Each question carries 20 marks.
(c) Answer questions in the script book.

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DO NOT TURN OVER THIS EXAM PAPER UNTIL
YOU ARE INSTRUCTED TO DO SO.

1. Software Testing

   (a) What are the aims of software testing? [2 marks]

   (b) Describe the overall process of *test-driven development*. [4 marks]

   (c) Explain the statement that "testing can only prove the presence of errors, not their absence." [2 marks]

   (d) For most users, it is not necessary for a piece of software to be free of defects. Do you agree or disagree with this statement? Justify your answer. [4 marks]

   (e) What is *partition testing*? Describe how you would use partition testing to test a procedure which checks whether an input string is a palindrome (i.e. reads the same forwards as backwards). [4 marks]

   (f) Mutation testing is a form of testing which involves automatically modifying a program and running a test suite on the modified ("mutant") program. The quality of a test suite can then be measured by the number of mutant programs which fail the tests. Discuss the possible advantages and disadvantages of mutation testing as a technique for improving software quality. [4 marks]

[Total marks 20]

2. Dependability and Security

(a) The four principal dimensions of dependability are *availability*, *reliability*, *safety* and *security*. Define each of these terms. [4 marks]

(b) Which dependability attributes are likely to be most important for a telecommunications system (such as a mobile telephone network)? Justify your answer. [2 marks]

(c) Consider a software-controlled insulin pump, as discussed in lectures, which automatically delivers the correct dose of insulin to a patient. Identify *three* hazards that may arise in this system, and for each one give a requirement to reduce the probability that a hazard will result in an accident. [6 marks]

(d) Consider an online shopping system, such as Amazon. Describe, giving examples, the kinds of damage which could result if such a system was insecure. [5 marks]

(e) Why is it difficult to test the extent to which a system is secure? [3 marks]

[Total marks 20]

3. Software Development Processes

(a) Explain the difference between *plan-driven* and *agile* methods. [2 marks]

(b) For the following systems, state what kind of process model would be appropriate for developing each, and describe the considerations which justify your choice.

(i) An online multiplayer adventure game developed by a small company with limited resources. [2 marks]

(ii) A payroll system for a large company, designed to replace an existing system which runs only on obsolete hardware. [2 marks]

(iii) A control system for an electronic voting machine. [2 marks]

(c) From a customer's point of view, what are three main benefits of Scrum? [3 marks]

(d) Describe the events which take place in a Scrum sprint cycle. Use a diagram to illustrate the order of these events. [4 marks]

(e) What challenges are involved in applying agile methods to large scale projects? Describe how you might address these challenges. [5 marks]

[Total marks 20]

4. Requirements Engineering

(a) What are *non-functional* requirements and how do they contrast with *functional* requirements? [3 marks]

(b) Give an example of a non-functional requirement for an online banking system. [1 mark]

(c) Describe *four* properties of a good requirements specification. [4 marks]

(d) Read the following requirements for an online shopping system, and identify whether they are *functional* or *non-functional* requirements. For each, describe how it could be improved to better satisfy the properties of a good requirements specification.

(i) The system should allow a customer to order an item to be delivered by mail. [2 marks]

(ii) The system should keep every customer's data secure. [2 marks]

(iii) The system should be easy for customers to use. [2 marks]

(e) Consider the following requirements of the online shopping system described in question 4.(d):

(i) A customer can make an order.

(ii) A customer can check the status of an order.

(iii) An employee can process an order (i.e. pack an item and deliver it).

Develop a UML use case diagram for these requirements. For each requirement, give the *preconditions*, and *postconditions*, if any. [6 marks]

[Total marks 20]

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