

University of St Andrews



DECEMBER 2021 8 HOUR TAKE HOME EXAM SCHOOL OF COMPUTER SCIENCE

MODULE CODE:	CS5030
MODULE TITLE:	Software Engineering Principles
TIME TO HAND IN:	8 hours
EXAM INSTRUCTIONS	<ul style="list-style-type: none">a. Answer all three questionsb. Each question carries 20 marks

This assessment consists of exam-style questions and you should answer as you would in an exam. As such, citations of sources are not expected, but your answers should be from your own memory and understanding and significant stretches of text should not be taken verbatim from sources. Any illustrations or diagrams you include should be original (hand or computer drawn). You may word-process your answers, or hand-write and scan them. In either case, please return your answers as a single PDF. If you handwrite, please make sure the pages are legible, the right way up and in the right order. Your submission should be your own unaided work. While you are encouraged to work with your peers to understand the content of the course while revising, once you have seen the questions you should avoid any further discussion until you have submitted your results. You must submit your completed assessment on MMS within 8 hours of you downloading the exam. Assuming you have revised the module contents beforehand, answering the questions should take no more than three hours.

1. Software processes:

Consider the scenario in which you are an employee of a small start-up company, which has won the contract to build a software system for the local police force. This police force already has a software system that stores data about its police officers, including their work arrangements (part time, flexible working, etc indicating working hours) and approved annual leave periods. It also logs incidents reported to the force or handled by the force. Police officers regularly patrol the area covered by the force either on foot or in cars. The new system will produce a weekly schedule of patrols for the area. The schedule will contain details of patrol routes, dates, times, officers allocated to each route and patrol mode (on foot or in a car). The new system should allow the frequency of patrols to be customised by the user. It will interact with the existing local system and the national crime agency database in producing patrol schedules. The Superintendent of the force is the only person who will have access to the new system. Police officers can view their own weekly schedules via the existing system. The system will also produce an analysis report for a given time period to help explore the impact of patrols on crime numbers in the area.

- (a) Specify 3 functional and 3 non-functional requirements for this system.
[6 marks]
- (b) Identify 2 potential ethical concerns for this development and specify 2 further requirements or constraints that would address these concerns.
[4 marks]
- (c) Which software development process would you adopt for this system? Justify your answer.
[3 marks]
- (d) Identify an overall software architecture style that would be suitable for this system, describing its elements and interaction patterns and justifying your choice of style.
[7 marks]

[Total marks 20]

2. Software maintenance, evolution and reuse:

The Fife Ornithology Society has a web-based application that allows members of the public to report sightings of rare birds in Fife. The Society commissioned a professional freelance developer to build this application a number of years ago. The associated website publishes a non-exhaustive list of rare birds that have been or may be observed locally. The online form for reporting sightings requires people to identify themselves with their name and email address. They can then submit details of the sighting, including characteristics of the bird, location, up to 3 photographs and a provisional identification. Club officials will then take action to confirm the sighting. The club database is updated with reported and confirmed sightings. In addition to this system, the club now wishes to release a free app with similar functionality that people can use on their mobile devices to report sightings.

Note: Ornithology is the study of birds.

- (a) Briefly outline 2 advantages and 2 disadvantages of offering 2 different systems for the same purpose. [4 marks]
- (b) Identify 2 components of the original system that can be reused or shared by the new app. Justify your choices. [3 marks]
- (c) Outline 4 factors that could lead to changes to the systems used by the Society following the release of the app. [4 marks]
- (d) The Society has the option of creating a product line of applications with functional specialisation based on the existing system. Describe 2 additional products (other than the proposed app) that could be created to form such a product line and explain how they form a product line. [6 marks]
- (e) Sometime later, the Society is considering whether it should replace the existing systems and create a new one. Outline 3 factors it should take into account when making this decision. [3 marks]

[Total marks 20]

3. Software quality:

A bank wishes to augment the online personal banking services it provides to its customers. The existing online banking functionality allows customers to view their accounts, open new accounts, close existing accounts, transfer money between accounts, set up standing orders and pay bills. The main purpose of the new service is to automatically maximise the interest customers can earn based on current interest rates offered by the bank as well as any penalties associated with withdrawals or early closures. If customers sign up for this optional service, the banking system allows them to specify information such as regular outgoings each month, the minimum amounts to be kept in current and instant access savings accounts at any time and the maximum period to which money can be tied up in fixed term savings accounts. Based on this data, the system will automatically distribute the money the customer has into different types of account on a specified date each month. The customer can opt out of the service at the end of a chosen month.

- (a) Identify the dependability attributes applicable to this system and briefly describe what they mean in this specific context. [8 marks]
- (b) Outline 3 potential threats to the dependability of this system. [3 marks]
- (c) For each threat from question 3 (b), describe one tactic that can prevent or reduce the threat. [3 marks]
- (d) Assuming that the standard online banking functionality already exists and you have developed the new service to incorporate into the system, describe 3 kinds of testing that are important, justifying your answer. [6 marks]

[Total marks 20]

***** END OF PAPER *****