Strathmore
UNIVERSITY

FACULTY OF INFORMATION TECHNOLOGY
BACHELOR OF SCIENCE IN BUSINESS AND INFORMATION TECHNOLOGY/
BACHELOR OF SCINECE IN INFORMATICS AND COMPUTER SCIENCE
END OF SEMESTER EXAMINATION
ICS 2201 - Software engineering - November 2019

DATE: 14th November 2019 Time: 2 Hours

Instructions

1. This examination consists of **FIVE** questions.
2. Answer **Question ONE (COMPULSORY)** and any other **TWO** questions.

QUESTION ONE (30 marks)

Consider the case study below and use it to answer the questions that follow

Acme engineering is a general light engineering company that specialises in metallic fixtures and fittings. It manufactures various products to customer order, and also has long term contracts to supply manufactured products to other companies. Acme is a "jobbing shop" involving craftspeople making specialised complete products – it is not a production line operation. The craftspeople work on early (6am – 2pm) and late (2pm – 10pm) shifts 5 days a week, and sometimes do overtime on Saturdays. The factory is always closed on Sundays. Each shift has a supervisor.

The management team consists of the Managing Director, Accountant and Sales Manager. They are assisted by two Administrative Assistants who work Monday to Friday, 8.30am to 5.30pm. The management team has decided that, in order to become more competitive, it needs more and better information on the costs involved in manufacturing. It wants to build up a database of time and cost information per manufacturing job, so that future work can be priced more accurately. This will involve recording the time spent on each manufacturing job, the costs of materials used, and the overhead costs.

One problem is that Acme's craftspeople have always had a free hand to carry out their work however they like, as long as the finished fixtures and fittings conform to specification and meet deadlines.

The MD has engaged an IT consultancy company to analyse the requirements and design a system to meet them. The team will include a consultant with extensive experience of implementing manufacturing control systems. Acme has provided the following list of requirements to the consultancy company:

- The system is to log the craftsperson, start and finish time and materials used for each manufacturing job. This must be possible on all shifts, including overtime.
- The data for time and materials used is to be captured on touch screens next to the machines on the factory floor so that the craftsperson's work is not disrupted. This facility is to be usable in a noisy and dirty workshop environment.
- The system is to calculate material costs and overhead costs incurred for each manufacturing job.
- The system is to provide a "time spent" analysis (time to set up, time per step, rework time) report of the work done by each craftsperson.
- The managing director would like a data mining type function to drill down on historic data and look at costs in total, or per product range, or per product type, or per craftsperson, over a flexible period of time, or for an individual piece of work.
- The sales manager has asked for secure remote access via VPN using a laptop to the historic data on the system when working away from the office.

Consider the case study above and answer the questions that follow:

a) Identify the general business objective of the Acme engineering company **(2 marks)**

b) i) During problem analysis phase, stakeholders write problem statements from their perspectives. Identify a stakeholder , and write a problem statement, on the problem experienced by Acme Company, from the stakeholders point of view **(4 marks)**

ii) Identify one benefit of solving the problem identified in b (i) **(1 mark)**

c) From the requirements provided by Acme, give one example of each of the following, justifying your selection in each case**:**

i) Two functional requirements **(2 marks)**

ii) Two non-functional requirements **(2 marks)**

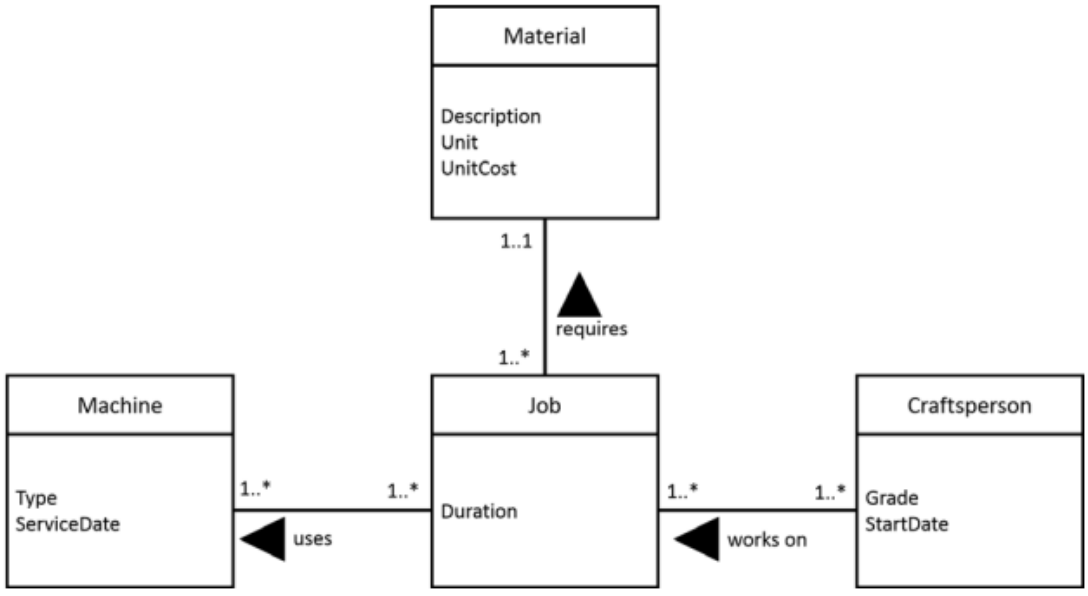
iii) Two solutions software developed can give **(2 marks)**

iv) Two ambiguous requirements **(2 marks)**

v) Two requirements in conflict with each other (i.e. one conflict across 2 requirements) **(2 marks)**

d) Identify two (2) different stakeholders or stakeholder groups whose requirements must be explored. In each case, identify which elicitation technique would be appropriate and provide a justification to support your selection. **(4 marks)**

e) The class diagram below has been produced to represent the data requirements of the new system. Review it against the requirements, and identify three (3) errors or inconsistencies where the requirements are not supported. **(6 marks)**



f) At the end of a Requirements Inception stage, a vision and scope document is produced. Briefly discuss the contents of a vision and scope document **(3 marks)**

QUESTION TWO (15 MARKS)

a) What is a software process? **(1 mark)**

b) A process model is a simplified representation of a software process. Differentiate between Iterative and incremental development models **(2 Marks)**

- Giving reasons for your answer suggest the most appropriate software process model that might be used as a basis for managing the development of the following systems:
- A virtual reality system to support software maintenance **(1 Mark)**
- A university accounting system that replaces an existing system **(1 Mark)**
- An interactive system that allows railway passengers to find train times from terminals installed in stations **(1 Mark)**

c) Describe four of the main principles of agile methods. Indicate how these are mapped (reflected) into the principles or practices of extreme programming. **(4 marks)**

d) How does a spiral model handle the need of risk management? **(2 marks)**

e) A prototype is a simplified model that demonstrates some behaviour you want to study.

i) Identify two instances where prototyping is used **(2 marks)**

ii) Identify two disadvantages of prototyping **(1 mark)**

QUESTION THREE (15 MARKS)

a. A software architecture has several audiences including fellow architects, programmers, configuration managers, testers and customers. All are interested in different information and look for different things within the architecture. Briefly describe the ***4 +1 model view*** used to make an architecture useful to all audiences **(5 marks)**

b. Enabling techniques are fundamental principles for the development of software. Balancing the trade-offs involved in using the enabling techniques helps you create an architecture that balances the functional and non-functional requirements of the system.

Briefly discuss the following ***enabling techniques*** and for each technique, identify a pattern used to achieve the benefit of the technique.

i) Modularization **(2 marks)**

ii) Separation of concerns **(2 marks)**

c. You want to develop a web-based application. The user types in a name and an email address and a word into a local client, and the server application looks up the word in a database and sends the contents of that database entry as an email message back to the user. Model the client, server, and database application as a message sequence diagram. Include as many error conditions as you can. (Explain any other requirements you have to assume if they are not explained here.) **(4 marks)**

d. Explain two properties of a good software architecture design **(2 marks)**

QUESTION FOUR (15 MARKS)

a) Why does software need to be tested? Give two reasons **(2 marks)**

b) Give one advantage of automated testing **(1 mark)**

c) State two differences between a bug a defect. **(2 marks)**

d) Differentiate between black box testing and white box testing **(1 Mark)**

e) Which type of testing exercises the system beyond its maximum design load for defects to be discovered? **(1 Mark)**

f) While applying for a job as a software tester, Peter comes across the following duties and responsibilities of the candidate.

- analysing users stories and/use cases/requirements for validity and feasibility
- collaborate closely with other team members and departments
- execute all levels of testing (System, Integration, and Regression)
- Design and develop automation scripts when needed
- Detect and track software defects and inconsistencies

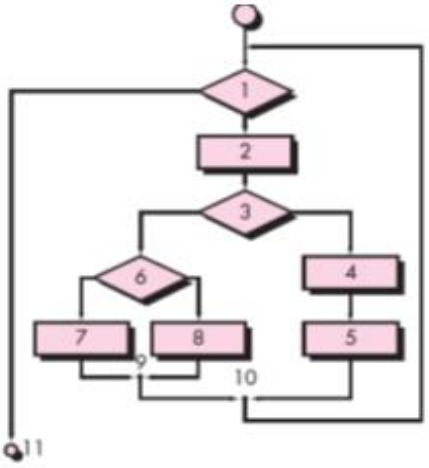
- Provide timely solutions
- Apply quality engineering principals throughout the Agile product lifecycle
- Provide support and documentation

List two non-technical and two technical skills required of Peter to meet the job's expectations **(4 marks)**

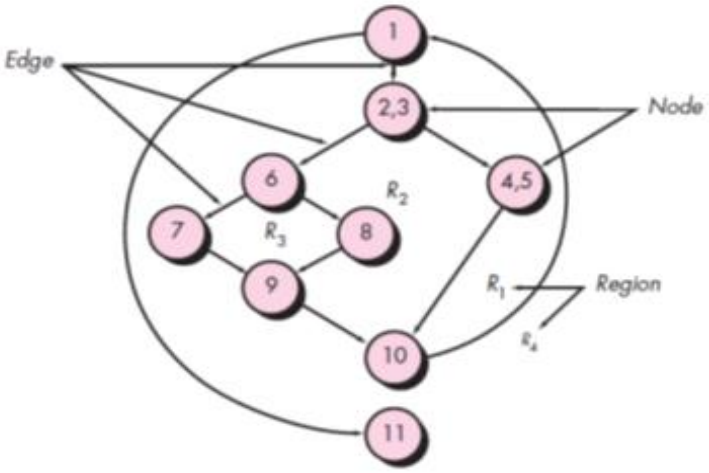
g) What is a test case? **(2 Marks)**

h) Cyclomatic complexity (CC) is a metric that provides a quantitative measure of the logical complexity of a program. It provides the upper bound for number of tests to be conducted to ensure all statements and conditions have been executed at least once.

Compute the CC for the flow graph below. **(2 Marks)**



System Flow Chart



Test Flow Graph

QUESTION FIVE (15 MARKS)

a.) "No matter where you are in the system life cycle, the system will change, and the desire to change it will persist throughout the life cycle." What is the origin of these changes? **(3 marks)**

b.) A version control system often keeps a version of a module and the set of changes between one version and the next version. Would a version control system keep the first version and the set of changes to successive versions or the last version and successive changes from the previous version? Why choose one approach over the other? **(2 marks)**

c.) Software engineering has been more focused on original development but it is now recognized that to achieve better software, more quickly and at lower cost, we need to adopt a design process that is based on systematic software reuse**.** Discuss two challenges faced during software reuse **(2 marks)**

d.) What are the issues that get discussed during project closure? **(3 marks)**

e.) Give three reasons for refactoring object oriented code (**3 marks)**

f**.)** Give two objectives of software restructuring **(2 marks)**