King Fahd University of Petroleum and Minerals
Information and Computer Science Department
SWE-205: 'Introduction to Software Engineering' (081)
Major # 1, November 5, 2008
Time: 90 Minutes

Instructor: Dr. Sajjad Mahmood

Name:	Student ID:

Question	Marks	Your Score

Notes:
1. The exam has ----- questions and consist of ------ pages.
2. You are expected to answer all questions.
3. This is a closed book exam.
4. Please free to use the back of the page. However, please make sure you indicate this in order for me to not miss it for grading.

1. **Question 1: True/False & Short Description.**   **[11 + 9 = 20 Marks]**
    a. **Mark the correct statements as True [T] and the incorrect statements as False [F]**
                                                    [12 Marks, 1 marks each]

1. Generic Products are systems which are commissioned by a particular customer. | F |

2. Software evolution is a process activity where the software is modified to adapt it to changing customer and market requirements. | T |

3. In Rational Unified Process (RUP), the goal of inception phase is to develop an understanding of the problem domain. | F |

4. A software design is a description of the structure of the software to be implemented. | T |

5. Software verification and validation is intended to show that a system conforms to its specification and that the system meets the expectations of the customer. | T |

6. A milestone is a project result that is delivered to the customer. | F |

7. Requirements discovery is the process of gathering information about the proposed and existing systems | T |

8. Risk planning process considers each of the key risks that have been identified and identifies strategies to manage the risk. | T |

9. Traceability is the set of activities that assess the impact and cost of the change. | F |

10. Consistency checks means the requirements document should include requirements, which define all functions, and constraints intended by the system user. | F |

11. Functional requirements are requirements that not directly concerned with the specific functions delivered by the system. | F |

    b. **Explain each of the following software process models. Be brief, concise and to-the-point.**   **[9 Marks, 3 Marks each]**

    The Waterfall Model

    The waterfall model takes the four fundamental process activities (specification, development, validation and evolution) and represents them as separate and distinct phases.

    Evolutionary Model

    Evolutionary model interleaves the activities of specification, development and validation.

Component-based software development
The Component-based software development process focuses on integration of pre-existing parts (commercial off the shelf components) rather than developing the system from scratch.

2. **Question 2: Software Engineering**   **[20 Marks]**

   a. What are the four important quality attributes which all software products should have?   **[8 Marks, 2 Marks each]**

Maintainibility, dependability, performance and usability.

   b. Many modern applications change frequently, before they are presented to the end-user and then after the first version have been put into use. Suggest four ways to build software to stop deterioration due to change.
         [8 Marks, 2 Marks each]

- Design software such that change in one part of a program does not create side-effects in another part of the program.
- Software has limited dependencies on the external devices or systems.
- Test cases and results are archived and available for future use.
- Spend time understanding what the customer needs.

   c. What is the difference between generic software development and custom software development?
         [4 Marks, 2 Marks each]

In generic software development, the specification is owned by the product developer. For the custom software development, the specification is owned by the customer.

3. **Question 3: Process Models**   **[12 + 4 + 4 = 20 Marks]**

   a. Suggest the most appropriate generic software process model that might be used as a basis for managing the development of the following systems. Given reason for your answer.

      [12 Marks, 4 Marks each]

      1. An interactive system that allows railway passengers to find train times from terminals installed in stations.

         A system with complex user interfaces needs a prototype developed to understand the requirements. Later, either an incremental development or a waterfall mode can be used.

      2. A virtual reality system to support software maintenance.

         These kinds of systems are better developed using exploratory approach because it is difficult to predict the requirements in advance.

      3. A patient management system that replaces an existing system.

         These types of systems have stable requirements because of the existing system and waterfall model can used to develop it.

b. State one advantage and one disadvantage of Component-based software development. **[4 Marks, 2 Marks each]**

Advantage: Component-based software development promotes software reuse and it has the potential to reduce software development cost and increasing software productivity.

Disadvantage: A Requirements compromise is inevitable and this may lead to a system that does not meet the real needs of users.

c. Describe the role of risk analysis in evolutionary process models like the spiral model. **[4 Marks]**

As each prototype is enhanced by iteration through the process steps, both the technical and management risks are assessed to see if it is still possible to complete the project which its required functionality with acceptable time and cost constraints.

4. **Question 4: Project Management** **[10 + 3+2+2+3 = 20 Marks]**
   The following table sets out a number of tasks, durations and dependencies.

Task	Duration (Days)	Dependency
T1	10	
T2	15	T1
T3	10	T1, T2
T4	20	
T5	10	
T6	15	T3, T4
T7	20	T3
T8	35	T7
T9	15	T6
T10	5	T5, T9
T11	10	T9
T12	20	T10
T13	35	T3,T4
T14	10	T8, T9

| T15 | 20 | T12, T14 |
| T16 | 10 | T15 |

a. Draw an activity chart showing the project schedule. **[10 Marks]**
b. Highlight the critical path on the activity chart. **[3 Marks]**
c. What is the minimum duration of the project? **[2 Marks]**
d. What will be the minimum duration of the project when the duration of T3 changes from 10 to 15 days? **[2 Marks]**
e. What will be the minimum duration of the project when the duration of T5 is changed from 10 to 15 days? **[3 Marks]**
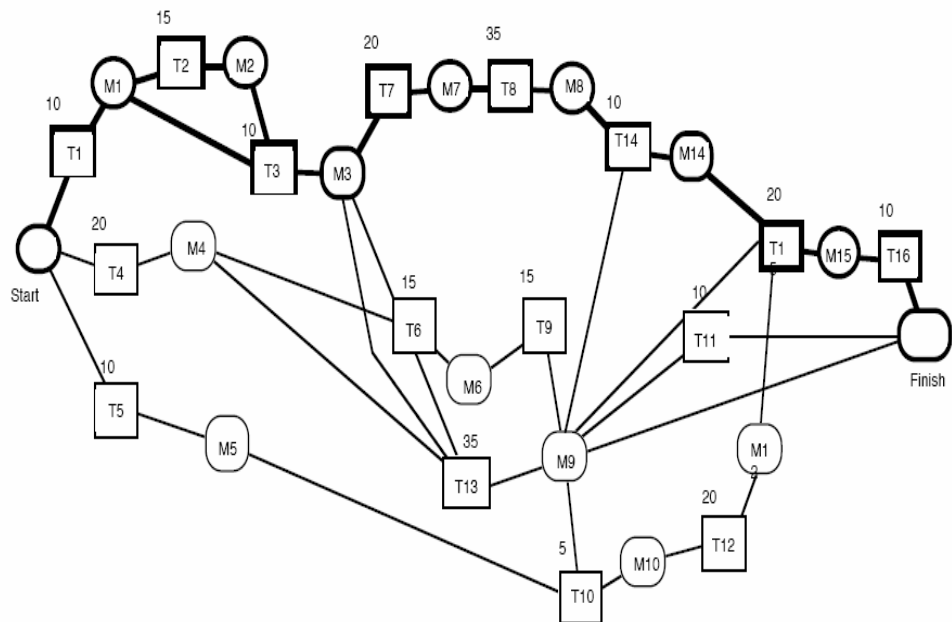
(c) 130 days; (d) 135 days; (e) 130 days

5. **Question 5: Software Requirements** **[18 Marks]**
   a. Identify three methods of validating requirements? **[6 Marks]**

   1. Requirements reviews
   2. Prototyping
   3. Test case generation

   b. Identify three types of non-functional requirements? **[6 Marks]**

1. Product requirements
2. Organizational requirements
3. External requirements

c. For all new systems, the requirements engineering process shall start with a feasibility study. The input to the feasibility study is a set of preliminary business requirements, an outline description of the system and how the system is intended to support business processes. Identify three aims of a feasibility study. **[6 Marks]**

1. Does the system contribute to the overall objectives of the organisation?
2. Can the system be implemented using current technology and within given cost and schedule constraints?
3. Can the system be integrated with other systems which are already in place?

6. **Question 6: Software Requirements** **[22 Marks]**

   a. An unattended petrol (gas) pump station system that includes a credit card reader. The customer swipes the card through the reader and then specifies the amount of fuel required. The fuel is delivered and the customer's account is debited.

   1. **For the natural language description of the following system, identify the high level requirement.** **[4 Marks]**

      The system should provide an unattended fuel delivery service where a specified amount of fuel is delivered to customers. The

cost of the fuel is deducted from the customer's credit card account.

2. **Identify seven sequences of actions to dispense fuel.**
                                                [14 Marks]

    1. The customer selects the type of fuel to be delivered.
    2. The customer inputs either a cash limit or maximum of amount of fuel to be delivered.
    3. The customer validates the transaction by providing credit card account details.
    4. The pump is activated and fuel is delivered.
    5. The transaction is terminated either when the pump nozzle is returned to its holster or when the customer's fuel or cash limit is reached.
    6. A receipt is printed for the customer.
    7. The fuel stock is updated.

b. A model university library system shall provide a financial accounting system that maintains records of all payments made by users of the system. System managers may configure this system so that regular users may receive discounted rates.

The above mentioned user requirement includes both conceptual and detailed information. Identify one detail that would have been better left to the system requirements specification.
       [4 Marks]

The requirement includes detail that the accounting system should support discounts for regular library users. This detail would have been left to the system requirements specification.