

Software Engineering (CS3009)

Date: November 4th 2024

Course Instructor(s)

Ansa Liaqat, Ayaz Gillani, Zeeshan Rana

Sessional-II Exam

Total Time (Hrs): 1

Total Marks: 40

Total Questions: 3

211-1808

Roll No

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BCS-7A

Section



Student Signature

Attempt all the questions.

1. Provide Solution of Q1 on page 1, solution of Q2 on Page 3, and solution of Q3 on page 5.
2. Avoid submitting an extra sheet.
3. There are 2 marks for following instruction 1.
4. Use of a single-sided, handwritten help sheet of A-4 size is allowed. Photocopies are not allowed.

CLO 2: Develop a model of requirements for a software system

Q1: The military is developing an autonomous robot named "ScoutBot" to provide critical support to soldiers during field operations. ScoutBot will operate in rugged, remote, and potentially hostile environments, assisting soldiers with real-time surveying and patrolling, threat detection, and on-demand supply delivery. It is designed to enhance mission effectiveness while prioritizing soldier safety. Further details about the ScoutBot are as follows:

ScoutBot must autonomously navigate two terrains (namely forests and deserts) by detecting obstacles and avoiding collisions. The bot will provide live video and audio feeds to the command center with a minimum resolution of 720p, allowing real-time monitoring of surroundings. Additionally, ScoutBot is responsible for detecting threats, such as mines or hazardous materials. On detection of a threat the bot will alert the command center. ScoutBot will also act as a supply bot, capable of delivering essential items such as ammunition and medical kits upon request. Once delivered, the robot must confirm receipt with the requesting soldier to ensure the item reaches its intended recipient. To ensure secure communication, ScoutBot must use encrypted channels adhering to military-grade security standards. For operational resilience, it must function in extreme temperatures, ranging from -20°C to 50°C. ScoutBot's battery life is critical and should last at least 24 hours; the bot should provide low-battery notifications when power drops below 20%. For stealth operations, ScoutBot should operate quietly, maintaining noise levels under 20 decibels to avoid detection. Finally, ScoutBot must be serviceable in the field; it should be designed with modular components that allow soldiers to perform basic maintenance and repairs using standard military tools.

To Do: Identify and list 5 functional requirements and 5 non-functional requirements for ScoutBot. All requirements should be testable and follow a standard format with hierarchical numbering.

Ensure that your answers directly reflect the needs described in the case study without adding any additional context or information. [5+5=10 marks]

CLO 3: Design architecture of a software system by choosing the most appropriate archi styles

Q2: Consider the following DFD for the system of an e-commerce business. Data stores and some arrow labels have been removed for simplicity. Assume that the DFD has been refined to the required level already. Note that the system finalizes an order only if the ordered products are available, otherwise the system displays the alternate similar products and the customer has to give a new order.

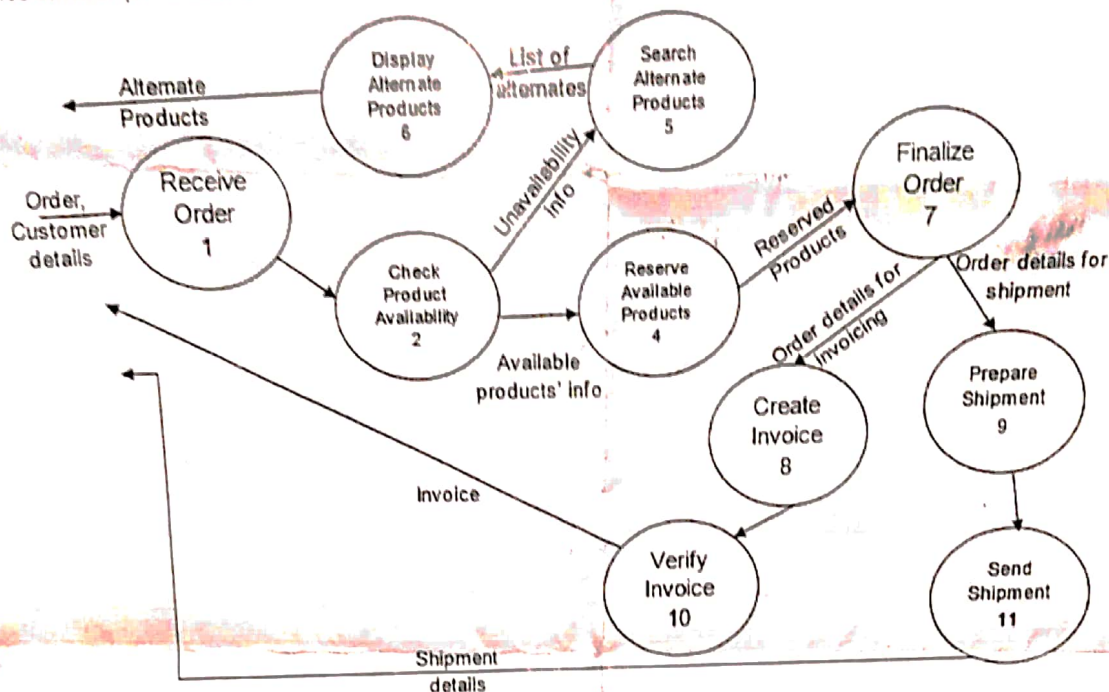


Figure 1: DFD of an E-commerce System

To do: Perform structured design and provide the call-and-return architecture for this DFD. Use the structured design heuristics to provide the final (i.e., most refined) architecture. Identify the types of flows and mark the flow boundaries after carefully redrawing the DFD. [10+4=14 marks]

CLO 3: Design architecture of a software system by choosing the most appropriate archi styles

Q3: Consider a real-time weather monitoring and alert system that collects weather data (such as temperature, humidity, wind speed, and pressure) from various sensors. The system processes the data, and distributes alerts to subscribed users in case of severe weather conditions. The system has a sensors communication interface that interacts with the sensors to collect data. These data are sent to a set of modules responsible for transforming the data into specific format so that the same set of modules can use the formatted data for aggregation which is then used for visualization. This visualization is then presented (by a separate set of modules) in mobile as well as web application so that the users can view the information in a friendly manner. In case a user subscribes with a particular presentation (for example rising humidity trends), the presentation module generates an in-app alert whenever a new visualization is available.

To do: Provide a well-labelled architecture diagram for the given scenario using the appropriate architecture styles. Clearly label the architecture styles. The diagram should be detailed enough to show the placement and interactions of the system's modules. Explicitly provide (in a single line) a comma separated list of all the architectural styles used in the architecture diagram. Justify the use of each architecture style in not more than a single sentence for each style. [10+1+3=14 marks]

Note: State your assumption(s) clearly. The architecture diagram should not be a high level (and generic) diagram only.