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Make necessary assumptions, and clearly mention these assumptions in the answer script. Please do not ask any clarifications to the invigilators.

1. Compare 5 architectural styles based on any 5 quality attributes. Give a tabular comparison along with a detailed explanation of why one architectural style is better than the other for the said quality attribute? 8 Marks

2. Explain the difference between the system use case and business use case based on the following case study of Library management systems 8 Marks

**Case Study**

Library management systems help libraries keep track of their documents inventory and loans, and member subscriptions and profiles, sometimes for multiple physical locations. Libraries rely on library management systems to manage asset collections as well as relationships with their members. This type of software solution can be used by educational institutions' libraries, as well as public or private libraries. Library patrons use library management systems to find, reserve, and loan documents while library staffs employ it to manage the acquisition, cataloging, and inventory of documents.

3. Consider a fluid level controller system used to maintain the fluid level in a tank at a constant value. The system is composed of four components (or blocks): a level sensor S, control logic L, a group motor/pump P, and a valve V. The components are connected in series. In order to compute the reliability of the system we need to know the reliability of its components, the components have exponential failure time distribution. Consulting a data bank, the following values were obtained (expressed in failures per hour or  $f\text{ hr}^{-1}$ ):

- a. S = Level sensor  $\lambda_s = 2 \times 10^{-6} \text{ f hr}^{-1}$ ,
- b. L = Control logic  $\lambda_L = 5 \times 10^{-6} \text{ f hr}^{-1}$ ,
- c. P = Group motor/pump  $\lambda_P = 2 \times 10^{-5} \text{ f hr}^{-1}$ ,
- d. V = Valve  $\lambda_V = 1 \times 10^{-5} \text{ f hr}^{-1}$

Find out the reliability  $R(t)$ , unreliability  $F(t)$  and mean time to failure (MTTF) for the complete system for a time period of  $t = 8760 \text{ hr}$ . 4 Marks

4. Discuss the Markov model with state transition diagram for a 2-component parallel system, Where the components are non-repairable. Assume  $\lambda_A$  --- Component A failure rate and  $\lambda_B$  --- Component B failure rate. Derive the state Equations for every state. Convert the same (2-component parallel system) to a Petri-Net model with detailed Explanation? 5 Marks

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