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**ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)**  
**ORGANISATION OF ISLAMIC COOPERATION (OIC)**  
**Department of Computer Science and Engineering (CSE)**

**MID SEMESTER EXAMINATION**  
**DURATION: 1 HOUR 30 MINUTES**

**WINTER SEMESTER, 2022-2023**  
**FULL MARKS: 75**

### CSE 4547: Parallel and Distributed Systems

**Programmable calculators are not allowed. Do not write anything on the question paper.**  
**Answer all 3 (three) questions.** Figures in the right margin indicate full marks of questions whereas corresponding CO and PO are written within parentheses.

1. a) Consider the chord architecture shown in Figure 1 where both the node ids and data items keys are 5-bit. Here the dark gray circles represent the nodes present in the system while the circles with dotted lines represent the presence of only the data items. Each node is connected to the immediate next node in the system. There are also shortcuts between some of the nodes which is shown in the figure as well. A query is now made to node 14 for the data item with key value 10. Describe the steps that are taken to locate the data item.

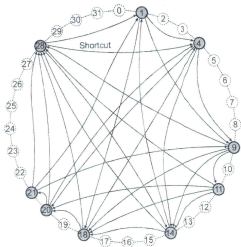


Figure 1: Chord architecture for Question 1.a)

- b) What are the advantages of using a Virtual Machine Monitor instead of a Runtime Environment? Describe two different methods for implementing a Virtual Machine Monitor. 5 + 6  
(CO2)  
(PO1)
- c) Differentiate between: 3 × 2  
(CO2)  
(PO1)
- i. Stateless and Stateful servers
  - ii. Concurrent and Iterative servers

2. a) Alice wants to order some groceries online from the website FoodKoala. FoodKoala does not have its own inventory of grocery items. The website simply connects its users with other stores that sell grocery items. Each of the grocery stores maintains a personal database server to keep track of their inventory and the Foodkoala website is able to communicate with these servers. Alice decides to buy products from the stores UniBazaar, WalStore, and BetterBuy in her single order on the FoodKoala website. Suggest an efficient way to process Alice's transaction request within the distributed system. 8  
(CO3)  
(PO2)
- b) What are the limitations of a Sensor Network? How do the nodes in such a network overcome these limitations to coordinate with each other? 7  
(CO2)  
(PO1)
- c) Differentiate between Event-based coordination and Shared Data-space coordination with the help of appropriate figures. 10  
(CO2)  
(PO1)
3. a) Give a practical example for each of the following types of transparency: 5 × 2  
(CO2)  
(PO1)
- i. Relocation
  - ii. Failure
  - iii. Migration
  - iv. Concurrency
  - v. Access
- b) When is it necessary to scale the size of a distributed system? Mention the different techniques that can be applied for scaling the size. 2 + 8  
(CO2)  
(PO1)
- c) 'Middleware is the same to a distributed system as what an operating system is to a computer' - Write a short note either in favor or against this statement with proper justification. 5  
(CO2)  
(PO1)