BACHELOR OF INSTRUMENTATION AND ELECTRONICS ENGG EXAMINATION

3RD YEAR, 2ND SEMESTER, 2018

COMPUTER ORGANIZATION AND NETWORKING

Time: 3 hours **Full marks: 100**

Answer 1 question from each group

GROUP- I (CO1)

1. a) What is the main drawback of contiguous memory allocation? State the 50-percent rule in this regard.

b) Assume in a memory management system, a page size is of size 4KB and that the page table entry takes 4 bytes. Calculate the size of the physical address space in MB. If the TLB contains 2048 number of entries thus having $1/8^{th}$ of the total number of entries contained in the conventional page table, calculate the size of the virtual address space (in GB), the TLB Reach (in MB), the approximate size of the memory required to store the conventional page table in memory (in MB) and the number of entries in the inverted page table.

c) Consider a paging system with the page table in memory. Each memory reference takes 200ns and the time needed for accessing the TLB is almost negligible. If the effective memory access time is 25% more than that of the main memory access time, calculate the hit ratio.

[(2+2)+(2+3+3+3+2)+3=20]

Or,

2. a) Write down the 2-address and 1-address instruction set for executing the following statement.

X=((A+B*C-D)+(E/F-G))-H

b) Discuss the various fields of an instruction. Explain the significance of the opcode field of an instruction.

c) Consider a logical address space of 8 pages of 1024 words; with each page mapped onto a physical memory of size 512 MB. How many bits are stored in the conventional page table and how many bits are needed for searching the page table?

d) The execution of a process in a system demands 90% hit ratio where the TLB access time and memory access time are respectively 10ns and 90ns. Calculate the effective memory access time. Hence calculate the percentage slowdown in memory access time.

[(4+4)+(2+2)+(2+2)+(2+2)=20]

GROUP-II (CO2)

3. a) Below is a table of processes and their associated arrival time (AT) and CPU burst time (BT) given in milliseconds.

Process	AT	BT
P1	0	5
P2	3	5
P3	5	3
P4	7	2

Answer the following.

i. Queue wait time of process P4 under FIFO scheduling algorithm

ii. The turn-around time of process P3 under FIFO scheduling algorithm.

iii. Queue wait time for process P1 under RR scheduling (time quantum=1 unit) scheduling algorithm.

iv. The turn-around time of process P2 under RR scheduling algorithm.

v. The average waiting time of all the processes under SRTF scheduling.

b) Suppose a disk drive has 200 cylinders, (0 to 199). The head's current position is 50. A queue of pending request is (in FIFO order) given as: 88, 190, 40, 45, 120, 50, 128, 68, 56, 70. Calculate the total number of head movements to serve the requests under SCAN and C-LOOK scheduling algorithms.

[(3x5)+(2.5+2.5)=20]

Or

4. a) Consider a memory system with 4 physical memory frames (initially empty) and the following reference string over the given pages (come in the order as specified): 1,2,3,4,2,1,5,6,2,1,2,3,7,6. What will be the final contents of the physical memory if LRU and OPT page replacement algorithms are used separately? Hence calculate the percentage of page faults for both.

b) In a system with 90 frames, consider there are 2 processes P1 of size 20KB and P2 of size 150KB running at any instant. How many frames will be allocated to each of the process by proportional allocation algorithm?

c) Define the following terms:

Dispatch latency, Process turnaround time, Response time, Seek time.

d) Write a short note on disk interleaving.

[(3+3+2)+3+(1.5x4)+3=20]

GROUP-III (CO3)

5. a) Draw the signal pattern for the bit stream of 01100100 using NRZ-I, RZ and Differential Manchester encoding scheme.

b) How many types of network topologies are there? Which type of these topologies requires the maximum number of wires to form a network? Calculate the number of wires needed to form a network of that topology with N number of devices. Now compare this topology and star topology in terms of robustness, security, reconfiguration complexity and fault tolerance.

c) How can you distinguish between NRZ and RZ scheme of encoding? Justify your answer in terms of bandwidth consumption.

[(3+3+3)+(2+1+2+4)+2=20]

Or,

6. a) Distinguish between half duplex and full duplex mode of data flow in a network. Discuss any 3 fundamental characteristics on which the effectiveness of a data communication system depends.

b) How do you measure the bit rate of a noiseless and a noisy channel? Suppose we need to send data at 265kbps over a noiseless channel with a bandwidth of 20kHz. How many signal levels do we need?

c) Define decibel. What do you mean by attenuation of a signal? A signal travels through an amplifier and its power is increased to 20 times. Calculate the power gain of the signal.

d) Explain whether a ring topology is advantageous or disadvantageous in terms of fault isolation. What is the main drawback of ring topology?

[(2+3)+(3+3)+(1+1+3)+(2+2)=20]

GROUP-IV (CO4)

7. a) Design a sender site algorithm for GO Back N ARQ. What does ARQ stand for? What does this N signify?

b) Discuss the main drawback of GO Back N ARQ protocol. Explain how Selective Repeat ARQ provides an improvement over it. Use necessary diagrams to illustrate.

c) Suppose a sender has to send a dataword (in the form of a polynomial) x^6+x^3+1 to the receiver. The divisor agreed upon both by the sender and the receiver for the mechanism of Cyclic Redundancy Check (CRC) is x^3+x+1. Find out the codeword (in polynomial form) that has to be sent from the sender to the receiver end. Next show how the receiver verifies whether the received codeword is valid or corrupted.

[(6+1+1)+(3+3)+(3+3)=20]

Or,

8. a) Explain why ALOHA and Polling fall under the category of Random access and controlled access respectively of Media Access Control protocols. State the main drawback of ALOHA that CSMA overcomes.

b) Show graphically how slotted ALOHA improves the performance over pure ALOHA.

c) Explain the working principle of CSMA/CD with the help of a flowchart. State the significance behind waiting for the amount of Backoff time by a station instead of trying to send the frame immediately after a collision is occurred under this protocol.

[(3+2)+6+(6+3)=20]

GROUP-V (CO5)

9. a) An ISP is granted a block of addresses starting with 150.80.0.0/16. The ISP wants to distribute these blocks to 2600 customers as follows.

i. the 1st group has 200 medium-size business; each needs 16 addresses.

ii. The 2nd group has 400 small business; each needs 8 addresses.

iii. The 3rd group has 2000 households; each needs 4 addresses.
Design the subblocks and give the sash notation for each subblock. Find out how many addresses are still available after these allocations.

b) Suppose in a block of IP addresses, we know the IP address of one host is 131.38.14.52/18. Calculate the network address and the last address that can be assigned to a machine on the network. Find the maximum number of hosts that can be connected to the network? Also find the range of assignable IP addresses.

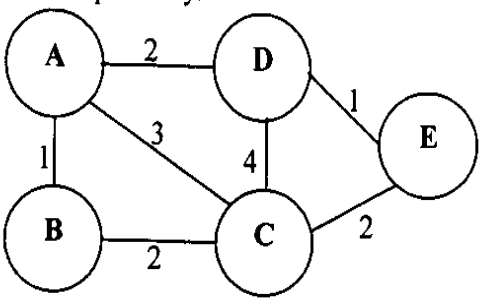
c) The IP address of a host and the subnet mask for the network are given as 26.65.42.2 and 255.255.224.0 respectively. Calculate the subnet address to which the host is connected on and also the range of assignable IP addresses on the above subnet.

[(9+2)+(2+3)+(2+2)=20]

Or,

10. a) Discuss the two circumstances under which a routing table is updated in a network. Explain the significance of netmask in an IP address.

b) Consider the following network with 5 nodes. Calculate the routing tables for the nodes A and D using distance vector routing algorithm. Show the steps clearly.



c) Formulate the shortest path trees for the nodes B and E of the above network using Dijkstra's algorithm. Hence calculate the routing tables for those nodes.

[(2+2)+(4+4)+(3+3+2)=20]

Course outcomes:

CO1: **Discuss** and **illustrate** the design and architecture of memory and processor.

CO2: **Discuss** and **describe** the various functionalities of operating systems, pipelining and vector processing.

CO3: **Describe** the different network topologies and fundamentals of computer networks.

CO4: **Explain** and **analyze** the data link layer protocols and media access protocols.

CO5: **Demonstrate** and **analyze** different routing protocols and network protocols.