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VIT
Vellore Institute of Technology
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SCHOOL OF COMPUTER SCIENCE AND ENGINEERING
CONTINUOUS ASSESSMENT TEST - I
FALL SEMESTER 2025-2026

Programme Name & Branch	**: BTECH and CSE**
Course Code and Course Name	**: BCSE308L and Computer Networks**
Faculty Name(s)	**: Common for all**
Class Number(s)	**: Common for all**
Date of Examination	**: 22.08.2025**
Exam Duration	**: 90 minutes** **Maximum Marks: 50**

General instruction(s): Answer All Questions

- CO1. Interpret the different building blocks of Communication network and its architecture.
- CO2. Contrast different types of switching networks and analyze the performance of network
- CO3. Identify and analyze error and flow control mechanisms in data link layer.
- BL – Blooms Taxonomy Level (2 – Understand, 3 – Apply, 4 – Analyze)

Q. No	Question	M	CO	BL
1.	A university campus is setting up a Hybrid network topology for its three main buildings (Library, Science Block, and Administration Block): Each building uses a Star topology with its own central switch. Library: 10 computers, each 15 m from its switch. Science Block: 12 computers, each 18 m from its switch. Administration Block: 8 computers, each 12 m from its switch. The three building switches are connected to a central data center router using a dual Ring topology. The distance between the library switch and the Science Block switch is 40 m. The distance between the Science Block switch and the Administration Block switch is 35 m. The distance between the Administration Block switch and the library switch is 45 m. Cable cost is $1.00 per meter. (2 marks each) a) Calculate the total cable length required for all the Star topology segments. b) Calculate the total cable length required for the dual Ring topology segment connecting the switches. c) What is the total cable length for the entire network? d) What is the total cost of cabling for the entire network? e) If the university decides to upgrade to fiber optic cables costing $2.50 per meter for the dual Ring topology connections only, calculate the new total cost. **a) Total cable length for all Star segments** Library: 10×15 m=150 m Science Block: 12×18 m=216 m Administration: 8×12 m=96 m Total (Star) = 150+216+96=462 m **b) Total cable length for the dual Ring segment** Single ring length = 40+35+45=120 m. Dual ring = 2×120=240 m **c) Total cable length for the entire network** Total = Star + Dual ring = 462+240=702 m	10	1	2

d) Total cost of cabling (at $1.00 per meter)
Cost = 702 m×$1.00/m =$702.00.
e) New total cost if dual Ring uses fiber at $2.50/m (stars remain $1.00/m)
Star cost = 462 m×$1.00=$462.00.
Dual ring cost = 240 m×$2.50 =$600.00
New total cost = 462+600=$1,062.00
Increase vs. original cost = $1,062 − $702 = $360

2. Six equal-sized datagrams of 1000 bytes travels over a link rate from source to router 3 is 1 Mbps and router 3 to destination is 1 Kbps, belonging to the same message travel to the destination one after another. However, they take different routes as shown in the following table. The delay for each router (including waiting and processing) is: 8 ms, 12 ms, 7 ms, 15 ms,10 ms. Assume the propagation speed is 2×10^{8} m/s. Compute the following: 10 2 3

a) Total delay (show step by step calculation) (6 marks)
b) Whether reordering is taking place or not. Substantiate your answer with valid statement? (2 marks)
c) Why reordering is not essential for virtual circuit approach? (2 marks)

Datagram	**Path length (km)**	**Visited routers**
1	5,000	1, 3, 4, 5
2	13,500	1, 2, 5
3	11,200	1, 4, 5
4	9,800	1, 3, 5
5	14,000	1, 2, 3, 5
6	7,500	1, 4, 2, 5

- Source transmission delay $T_s = L/R_s = 8000/10^6 = \mathbf{8}$ ms
- Final hop transmission delay $T_d = L/R_d = 8000/10^3 = \mathbf{8000}$ ms = 8 s
- Propagation delay for path length D km: $T_p = \dfrac{D \times 10^3}{2 \times 10^8}$ s $= 5 \times 10^{-6} D$ s $= \mathbf{0.005D}$ ms.

(So 5000 km → 25 ms, 13 500 km → 67.5 ms, ...)

a) Total delay

$$T_{\text{total}} = T_s + \left(\sum \text{router delays on its route}\right) + T_p + T_d$$

Dg	**Path (km)**	**Visited routers**	**Σ Router delay (ms)**	**Tp ms**	**Ts (ms)**	**Td(ms)**	**Total delay (ms)**	**Total (s)**
1	5 000	1,3,4,5	40	25.0	8	8000	**8073.0**	**8.073**
2	13 500	1,2,5	30	67.5	8	8000	**8105.5**	**8.1055**
3	11 200	1,4,5	33	56.0	8	8000	**8097.0**	**8.097**
4	9 800	1,3,5	25	49.0	8	8000	**8082.0**	**8.082**
5	14 000	1,2,3,5	37	70.0	8	8000	**8115.0**	**8.115**
6	7 500	1,4,2,5	45	37.5	8	8000	**8090.5**	**8.0905**

	b) Arrival order to the final link: 1, 4, 3, 2, 6, 5 Since that final 1 Kbps link is FIFO and very slow (8 s per packet), packets leave in this queue order, which differs from the source order (1,2,3,4,5,6). **Yes, reordering occurs** **c) Why reordering is not essential in a virtual-circuit approachs?** In a VC network all packets of a connection follow the same predetermined path. Hence packets naturally arrive in order, and explicit reordering at the destination is generally unnecessary.			
3.	A 250 mega-byte (MB) video file is to be transmitted from one server to another via e-mail, passing through four nodes of a connectionless network. The network forces packets to be of size 12 KB, excluding a packet header of 48 bytes. The distance between each pair of adjacent nodes is 350 km, and each server is 60 km away from its nearest node. All transmission links operate at 150 Mb/s. Assume the propagation speed is 2×10^8 m/s. The processing time at each node is 0.25 seconds. a) Find the propagation delay per packet between a server and a node, and between nodes. (4 marks) b) Calculate the transmission time (3 marks) c) Find the total time required to send the message. (3 marks) **a) Propagation delay** $$t_p = \frac{d}{v}$$ • **Server↔node (60 km = 60,000 m):** $t_{p,sn} = \frac{60{,}000}{2\times10^8} = 0.0003\ \text{s} = \boxed{0.3\ \text{ms}}$ • **Node↔node (350 km = 350,000 m):** $t_{p,nn} = \frac{350{,}000}{2\times10^8} = 0.00175\ \text{s} = \boxed{1.75\ \text{ms}}$ Propagation delay = 2(0.3 ms) + 3(1.75 ms) = 5.85 ms b) Transmission delay = $(250 * 10^6 * 8) / (150 * 10^6)$ = 13.33s processing time at each node = 4 (0.25) s c)Total time= $(5.85 * 10^{-3}) + 13.33 + 4(0.25)$ = 14.33585 s	10	2	3
4.	Prove and justify the following statements with suitable examples and illustrations: a) VRC check fails to detect an error if an even number of bits are inverted during transmission. b) LRC can't detect the burst error if two bits in one data unit is corrupted and two bits in the exactly same positions in another data unit corrupted. c) CRC can detect all burst errors of length less than or equal to the degree of the generator polynomial. d) Checksum method may fail to detect errors when two equal and opposite bit patterns occur in the same positions in different segments. VRC – 2.5 marks	10	3	4

	LRC – 2.5 marks CRC – 2.5 marks Checksum– 2.5 marks			
5.	Suppose the following message is to be transmitted to the receiver: "RUBY JUBILEE TOWER". a) Calculate the checksum for the given message and verify it at the receiver's end. *Hint:* HEX values for A–Z are in the range 0x41–0x5A and the empty space is 0x20. Assuming each section length is 4 Hex values. (5 Marks) b) Assume that the first hexadecimal value in section 3 and section 4 is corrupted in the least significant bit (LSB). How does the receiver detect the error? (5 Marks) **a) Sender side (5 marks)** RU-5255 BY-4259 J- 204A UB-5542 IL-494C EE-4545 T-2054 OW-4F57 ER-4552 ------------- 24DC8 - sum ----------- 4DCA- wrapped sum B235- checksum **Verification at receiver:** Add all words plus the checksum The packet is accepted. **b) Two LSB errors in section 3 and 4 (first byte of each) (5 marks)** Section 3 first byte 0x20 → LSB flip ⇒ 0x21 Section 4 first byte 0x55 → LSB flip ⇒ 0x54	10	3	4

	These two changes cancel out, so when the receiver adds the corrupted words plus the original checksum 0xB235, the total still equals 0xFFFF. Complement – 0000 Error- Not detected			