CMSC 417-0101 Computer Networks **Spring 2001**

Final Exam

Closed book and notes; In class *Saturday, May 19*

⊕ *Do not forget to write your name on the first page. Initial each subsequent page.*
⊕ *Be* **neat** *and* **precise**. **I will not grade answers I cannot read.**
⊕ *You should draw simple figures if you think it will make your answers clearer.*
⊕ *Good luck and remember, brevity is the soul of wit*

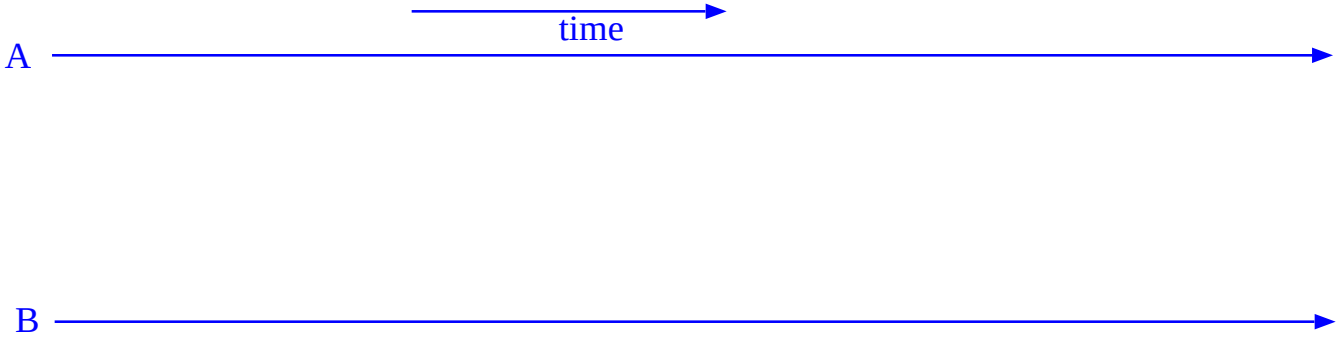
- All problems are mandatory
- I cannot stress this point enough: **Be precise**. If you have written something incorrect along with the correct answer, you should **not** expect to get all the points. I will grade based upon what you **wrote**, not what you **meant**.
- Maximum possible points: 60.

Name: _____

Problem	Points
1	
2	
3	
4	
5	
6	
Total	

1. TCP/IP

(a) Assume two hosts with IP addresses A and B communicate using TCP. Assume host B does not implement the two MSL time-wait state. Construct a detailed scenario, using the space-time diagram, where this causes TCP to fail. Precisely describe why TCP has failed and how the failure is manifested at higher layers. (4 points)



(b) Consider a 1 Gbps link with 250 ms one-way latency. In the absence of any other traffic and ignoring start-up effects, what is the bandwidth attainable on this link using TCP? Describe a mechanism to improve the situation. (2 points)

(c) Describe two benefits of subnetting. (3 points)

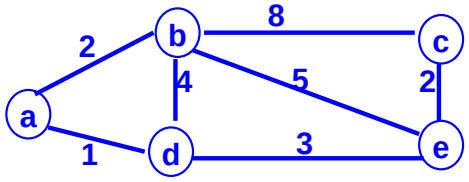


Figure 1: Topology for Dijkstra's algorithm

2. Routing

   (a) Describe how Dijkstra's algorithm works. Use the topology shown Figure 1 in your explanation. Assume your initial "Confirmed" set to be $\{(a, 0, -)\}$. (4 points)

(b) Construct an example where *Poison-Reverse* fails. (3 points)

(c) Sketch a proof of convergence for the *Distance-Vector* protocol. (3 points)

3. Application-layer protocols

(a) Why are persistent-HTTP connections useful? (4 points)

(b) Why don't news articles distributed using NTTP circulate forever in the network? (2 points)

(c) Assume n, ($n > 2$) application-layer processes are arranged in a ring. Each process has an unique address that other processes can use to send messages to. However, each process knows the identity of only its two neighbors. Describe an efficient unicast-based protocol for these processes to find the identity of the node with the *lowest* address. You may assume reliable communication between processes. (4 points)

4. MAC Layer

(a) Assume Poisson packet arrivals and retransmissions (recall that the probability of exactly k successes over time t in a Poisson distribution with mean λ is given by $\frac{(\lambda t)^k e^{-\lambda t}}{k!}$). Derive an expression for the throughput of Slotted-Aloha. (4 points)

(b) How are the A and C bits used in the 802.5 (Token Ring) protocol. (3 points)

(c) Derive an expression for the expected number of transmissions for the Aloha protocol. You do *not* have to simplify your expression. (3 points)

5. Moblity, NAT

(a) Why can't we just add new route table entries for mobile IP hosts on the Internet? (2 points)

(b) Precisely describe the tasks the *Home Agent* performs on behalf of a mobile host when two way encapsulation is used. (4 points)

(c) Describe three benefits of NAT. What is the major problem with NAT? (4 points)

6. Traceback and Scheduling

(a) What are two major advantages of "edge-sampling" over "node sampling"? (4 points)

(b) Construct an example where round-robin scheduling is unfair. (2 points)

(c) How does WFQ schedule its packets? Construct an example where WFQ is *fairer* than FIFO scheduling. (4 points)