

**CS 268 Midterm Exam
(Example)**

Name:

SID:

| Problem | Points |
|----------------|---------------|
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| Total | |

Remember to be concise

1) End-to-End (20 pts)

(a) State the end-to-end arguments. (10 pt)

(b) Give one example of functionality that according to end-to-end arguments should be implemented at the application layer, and one example of functionality that can be implemented at a lower layer, i.e., link or network layer. Justify your examples. (Use no more than two phrases for each example.) (10 pt)

2) RED (20 pts)

- (a) Name two problems RED tries to address. Explain. (10 pts)
- (b) Explain briefly how RED works. (10 pts)

3) Lookup (20 pts)

- (a) Explain briefly how Patricia tries work. What are the computation and the space complexities of this algorithm? (5 pts)
- (b) Give one example in which you might prefer to use Patricia tries over Lulea's lookup algorithm. (5 pts)
- (c) Propose a technique to decrease the time complexity of Patricia-based routing lookup. Identify the tradeoffs of the proposed change. (10 pts)

4) Fair Queueing (20 pts)

(a) Consider a set of n flows with the arrival rates of 1 Mbps, 2 Mbps, ..., and n Mps, respectively, and assume that all flows traverse a link with capacity of n Mps. What is the min-max fair rate f ? (10 pts)

(b) Explain the concept of virtual system time? Why is it needed? (10 pts)

5) TCP Congestion Control (20 pts)

- (a) Describe fast retransmission and fast recovery algorithms; pseudocode preferred. (5 pts)
- (b) Design a flow control protocols that achieves a throughput that is N times higher – where N is given – than the throughput of a single TCP flow between the same source and destination. Explain the design rationales. (15 pts)