

SIMON FRASER UNIVERSITY
SCHOOL OF ENGINEERING SCIENCE

Spring 2017
ENSC 427: COMMUNICATION NETWORKS
ENSC 894 SPECIAL TOPICS II: COMMUNICATION NETWORKS

Midterm No. 1
Wednesday, February 22, 2017

Duration: 50 minutes. Attempt all problems. Questions are not equally weighted.

Closed book and closed notes. Simple calculators (with no graphing/programming functions) are permitted. PDAs, laptops, and wireless phones are not permitted.

Please provide brief and concise answers and include diagrams, graphs, and tables, as needed. Expand all acronyms.

Please write legibly. Illegible text will not be graded. Please use a pen (no pencils, please).

1. Communication Networks and Service (15 points):

- (a) List main characteristics of a telephone network and show its hierarchical structure.
- (b) What is statistical multiplexing?
- (c) List essential elements of a computer network architecture.

2. Applications and Layered Architecture (20 points):

- (a) What are network layers? List network layers of the data network model.
- (b) Describe encapsulation and show its elements in case of a HTTP request.
- (c) Describe the role of HTTP proxy server and caching.
- (d) What are cookies and why are they used?

3. Digital Transmission Fundamentals (40 points):

- (a) What is the bandwidth of a signal? Compare bandwidth of a slow varying and a fast varying signals.
- (b) List two models of a communication channel and indicate the bandwidth of the channel.
- (c) What is line coding? Apply NRZ, Bipolar, and Manchester code to the sequence 1 1 0 0 1 0 1 0.
- (d) Calculate power density for these codes assuming that binary 0s and 1s occur independently and with equal probability.

4. ns-2 Tutorial (25 points):

Define a topology with two nodes that are connected by a link and consider the listed ns-2 code:

- (a) Create two nodes (n0 and n1) and connect these two nodes with a duplex link with the bandwidth 1.5 Megabit, a delay of 15 ms, and a DropTail queue. Insert your code in lines 14–16.
- (b) Create a CBR traffic source and attach it to a UDP agent udp0. The packet size should be set to 450 bytes and a packet will be sent every 0.005 seconds. Insert your code in lines 21–24.
- (c) Briefly describe the code in lines 26–27.
- (d) Schedule events for the CBR agent: start at 0.45 seconds and end at 5.0 seconds. Insert your code in lines 31–32.

```
1 set ns [new Simulator]
2
3 set nf [open midterm1.nam w]
4 $ns namtrace-all $nf
5
6 proc finish {} {
7     global ns nf
8     $ns flush-trace
9     close $nf
10    exec nam midterm1.nam &
11    exit 0
12 }
13
14                                     #fill in here for part (a)
15                                     #fill in here for part (a)
16                                     #fill in here for part (a)
17
18 set udp0 [new Agent/UDP]
19 $ns attach-agent $n0 $udp0
20
21                                     #fill in here for part (b)
22                                     #fill in here for part (b)
23                                     #fill in here for part (b)
24                                     #fill in here for part (b)
25
26 set null0 [new Agent/Null]
27 $ns attach-agent $n1 $null0
28
29 $ns connect $udp0 $null0
30
31                                     #fill in here for part (d)
32                                     #fill in here for part (d)
33
34 $ns at 6.0 "finish"
35
36 $ns run
```