CPSC 441
COMPUTER COMMUNICATIONS

IN-CLASS QUIZ

Department of Computer Science
University of Calgary
Professor: Carey Williamson

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This is a CLOSED BOOK in-class quiz. Textbooks, notes, laptops, personal digital assistants, and cellular phones are NOT allowed. However, **calculators are permitted**.

It is a 20 minute quiz, with a total of 24 marks. There are 8 questions, and 4 pages (including this cover page). Please read each question carefully, and write your answers legibly in the space provided.

When you are finished, please hand in your quiz to your TA. Good luck!

Student Name: _____

Student ID: _____

Score: _____ / 24 = _____ %

Multiple Choice

Choose the best answer for each of the following 4 questions, for a total of 4 marks.

1 1. The main distinguishing characteristic between "Routers" and "End systems" is:

(a) routers are typically owned by network providers, not by users

(b) routers are typically operated 24x7, unlike most end systems

(c) routers typically have multiple network interfaces and links, unlike most end systems

(d) routers are typically expensive, unlike most end systems

(e) all of the above

1 2. In the initial deployment of the Internet, the three primary network applications were:

(a) electronic mail, file transfer, and chat

(b) network news, file transfer, and the Web

(c) remote login, file transfer, and electronic mail

(d) file transfer, ssh, and electronic mail

(e) Facebook, YouTube, and eBay

1 3. Which of the following protocols is an example of a "push" protocol?

(a) Simple Mail Transfer Protocol (SMTP)

(b) Internet Mail Access Protocol (IMAP)

(c) Post Office Protocol (POP)

(d) Domain Name Service (DNS)

(e) none of the above

1 4. Which of the following protocols uses UDP as its underlying transport layer?

(a) Hyper Text Transfer Protocol (HTTP)

(b) Simple Mail Transfer Protocol (SMTP)

(c) Domain Name Service (DNS)

(d) BitTorrent (BT)

(e) all of the above

Protocol Stack

5 5. Oh no! Professor Williamson accidentally dropped his Internet protocol stack diagram, and now the layers are all mixed up. Use your knowledge of the Internet protocol stack to put it back together, by numbering each of the layers, with a 1 for the lowest layer, and a 5 for the highest layer. **In addition**, draw a line to connect each "logical unit" of communication to the layer with which it is properly associated.

```
___1___  Physical                packets (Network Layer)
___5___  Application             bits    (Physical Layer)
___4___  Transport               segments (Transport Layer)
___2___  Datalink                messages (Application Layer)
___3___  Network                 frames  (Datalink Layer)
```

HTTP

3 6. In class, we described HTTP/1.0 as a "stateless" application-layer protocol for the Web, and HTTP/1.1 as a "stateful" application-layer protocol. Give **three distinct examples** of features in HTTP/1.1 that involve "state" information at the end systems.

```
1. Persistent connections (and pipelining)
2. Cookies
3. Conditional GET (i.e., Web object caching)
Others: partial content, content transcoding, authentication,...
```

Socket Programming

6 7. The following alphabetical list shows some system calls that might be used in socket programming for network applications. Assuming a Client-Server application architecture, use a 'C' to indicate those socket system calls that are typically done at the Client, use an 'S' to indicate those socket system calls that are typically done at the Server, and leave blank those that are not usually associated with Client-Server socket programming. **In addition**, within each of the 'C' and 'S' categories, use a small positive integer (i.e., 1, 2, 3) to indicate the relative order in which the sytem calls normally occur. That is, you should write 'C1', 'C2', 'C3', ... and 'S1', 'S2', 'S3', ... at the appropriate places in this listing.

```
_________  abort()
______S4_  accept()
______S2_  bind()
_C5___S7_  close()
_C2______  connect()
_________  ipconfig()
______S3_  listen()
_C4___S5_  recv() (or read())
_________  select()
_C3___S6_  send() (or write())
_C1___S1_  socket()
_________  tcp()
```

Networking Delays

6 8. NASA recently beamed a digital copy of the Mona Lisa portrait to the moon (386,000 kilometers from the Earth) using a laser with a transmission rate of 300 bits per second (bps). The image was 152 pixels by 200 pixels, with 8 bits of gray-scale information for each pixel. The signal was transmitted at the speed of light, which is $3x10^8$ meters per second. Use your knowledge of networking delays to answer the following questions. **Show your work**, and please state any assumptions that you make.

(a) (2 marks) What was the transmission time for this image on this channel?

```
FileSize = 152 x 200 pixels x 8 bits/pixel = 243,200 bits (about 30 KB)

                    FileSize       243,200 bits
TransmissionTime = ------------ = --------------  = 810.667 seconds
                    DataRate       300 bits/sec
```

(b) (2 marks) Assuming that the network operators on Earth hit the "Send" button at time 0, at what time did the **first bit** of the image arrive at the moon?

```
                   Distance    386,000 km
PropagationDelay = -------- = ------------  = 1.287 seconds
                    Speed     300,000 km/sec
```

(c) (2 marks) Assuming no transmission errors or packet losses, and a single 40-byte acknowledgement for the entire image, at what time did the Earth-based network operators know that the image transmission had been completed successfully?

```
                  ACK Size     40 bytes x 8 bits/byte
ACM-XmitTime = ------------ = ----------------------  = 1.067 seconds
                  DataRate       300 bits/sec

TotalTime = Image-XmitTime + PropDelay + ACK-XmitTime + PropDelay

          = 810.667 sec    + 1.287 sec + 1.067 sec    + 1.287 sec

          = 814.306 seconds
```

*** THE END ***