# CPSC 441
# COMPUTER COMMUNICATIONS

# QUIZ SOLUTION

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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 32 marks. There are 5 questions, and 5 pages (including this cover page). Please read each question carefully, and write your answers legibly in the space provided. Good luck!

Student Name: _____

Score: _____ / 32 = _____ %

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Student ID: _____

## Network Terminology

6    1. In our introductory material on networking terminology, we discussed a "component-based" view of the Internet. The three main components were **Hosts**, **Links**, and **Routers**. **Give a clear and concise description** of what each of these components are.

(a) (2 marks) Hosts: `Hosts are ''end systems'' that exist at the edge of the network, not in the core. They are owned by users, and run a full protocol stack to support network applications. They typically have a single network link to access the Internet.`

(b) (2 marks) Links: `Links provide the channels for communication between other nodes (hosts and routers) in the network. Links can be wired or wireless, and can be point-to-point or broadcast.`

(c) (2 marks) Routers: `Routers exist in the core of the nework. They are owned by network operators, and run a reduced protocol stack (layers 1 to 3). They have multiple network interfaces to different links, and forward packets along these links based on the intended destination.`

## Networking Delays

8    2. There are four different types of "delay" that packets undergo when transiting the Internet. **List and describe** each of these delays, making sure to indicate where and how each type of delay occurs.

1. (2 marks) `Processing delay occurs at the originating node to construct and send a packet, as well as at each intermediate node that manipulates the packet. It is a small delay (perhaps a few hundred microseconds) based on the SW/HW steps involved for OS interrupt handling and data copying.`

2. (2 marks) `Queueing delay occurs when a packet has to wait its turn behind other packets at the outgoing network interface. This can also occur at intermediate routing nodes. Queueing delays can be highly variable (e.g., fraction of a second or several seconds).`

3. (2 marks) `Transmission delay occurs when the bits of a packet are placed serially onto the outbound channel. This delay is a function of packet size (in bits) and the data transmission rate (in bits per second). Typically on the order of milliseconds.`

4. (2 marks) `Propagation delay arises from the physical movement of bits to their destination. It depends on the signal propagation speed in the transmission medium, and the distance traveled. Typically a few usec or msec.`

## Application-Layer Protocols

6    3. Among the application-layer protocols that we studied, several can be used for the generic transfer of "files" in a client-server fashion. Three of these are FTP, SMTP, and HTTP. **Compare and contrast** these three protocols, based on their design characteristics, properties, assumptions, or implementation details. Point form is sufficient, but please make sure to state **at least 4 relevant points for each** of these 3 protocols.

| FTP (File Transfer Protocol) | SMTP (Simple Mail Transfer Protocol) | HTTP (Hyper-Text Transfer Protocol) |
|---|---|---|
| – data files | – email messages | – Web pages and objects |
| – simple ASCII commands | – simple ASCII commands | – simple ASCII commands |
| – session-oriented | – session-oriented | – transaction-oriented |
| – out of band signalling | – in band signalling | – in band signalling |
| – port 20 and 21 | – port 25 | – port 80 |
| – any file format | – structured (ASCII, MIME) | – HTML + other objects |
| – push or pull | – push | – pull |
| – old (big 3) | – old (big 3) | – ``new'' (1991) |

## Calculation

6    4. A friend of yours in rural Alberta would like to download a copy of *Lord of the Rings* from you in Calgary. Unfortunately, they only have a dialup modem with a capacity of 128 kbps. Recall that the file size is 430 MB, and your server link speed is 2.0 Mbps. Focusing on transmission time only, and assuming 100% utilization of their bottleneck link, **how long** would it take for your friend to download this movie? Would it be faster for you to drive there yourself (6 hours) with the DVD? If so, by how much? **Show your work.**

```
Data Size L = 430 MB = 430 x 2^20 Bytes x 8 bits/Byte = 3.6 x 10^9 bits


Data Rate R = 128 x 10^3 bits per second = 128,000 bps


                    L       3.6 x 10^9 bits
Transmission Time T = --- = ---------------------  = 28,180 seconds = 7.83 hours
                    R       1.28 x 10^3 bits/sec


Driving there in 6 hours is actually faster by 1.83 hours!!
```

## Domain Name System

6    5. The attached page shows the output of some `nslookup` and `dig` commands for some recent DNS queries. Use your knowledge of DNS to **answer the following questions**:

(a) (1 mark) What is the **full domain name** of the computer on which the commands were typed and run?

```
csg.cpsc.ucalgary.ca
```

(b) (1 mark) What is the name of the computer whose IP address was being queried?

```
cs.ubc.ca
```

(c) (1 mark) What is the IP address that was returned in response to this query?

```
142.103.6.5
```

(d) (1 mark) What is the IP address of the DNS server that answered the `nslookup` query?

```
136.159.5.75
```

(e) (1 mark) What is the IP address of the DNS server that answered the `dig` query?

```
128.233.3.1
```

(f) (1 mark) What is the IP address of the DNS server at UBC?

```
142.103.1.1
```

*** THE END ***

```
csg% date
Sat Feb  1 06:25:37 MST 2014

csg% hostname
csg

csg% nslookup
> cs.ubc.ca
Server:         136.159.5.75
Address:        136.159.5.75#53

Non-authoritative answer:
Name:   cs.ubc.ca
Address: 142.103.6.5


csg% dig @access.usask.ca cs.ubc.ca

; <<>> DiG 9.3.4-P1 <<>> @access.usask.ca cs.ubc.ca
; (1 server found)
;; global options:  printcmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 1880
;; flags: qr rd; QUERY: 1, ANSWER: 0, AUTHORITY: 2, ADDITIONAL: 2

;; QUESTION SECTION:
;cs.ubc.ca.                     IN      A

;; AUTHORITY SECTION:
ubc.ca.                 77550   IN      NS      dns3.ubc.ca.
ubc.ca.                 77550   IN      NS      hub.ubc.ca.

;; ADDITIONAL SECTION:
dns3.ubc.ca.            70534   IN      A       142.103.1.1
hub.ubc.ca.             31648   IN      A       137.82.1.1

;; Query time: 12 msec
;; SERVER: 128.233.3.1#53(128.233.3.1)
;; WHEN: Sat Feb  1 06:26:59 2014
;; MSG SIZE  rcvd: 102

csg% date
Sat Feb  1 06:28:12 MST 2014
```