

CPSC 441
COMPUTER COMMUNICATIONS
MIDTERM EXAM

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

It is a 50 minute exam, with a total of 50 marks. There are 12 questions, and 8 pages (including this cover page). Please read each question carefully, and write your answers legibly in the space provided. You may do the questions in any order you wish, but please USE YOUR TIME WISELY.

When you are finished, please hand in your exam paper and sign out. Good luck!

Student Name: _____

Student ID: _____

Score: _____ / 50 = _____ %

Multiple Choice

Choose the best answer for each of the following 8 questions, for a total of 8 marks.

- 1 1. In the early days of the Internet, the three primary network applications were:
 - (a) electronic mail, file transfer, and the Web
 - (b) network news, file transfer, and the Web
 - (c) electronic mail, file transfer, and remote login
 - (d) file transfer, ssh, and electronic mail
 - (e) Facebook, YouTube, and Flickr

- 1 2. On today's Internet, electronic mail is provided using:
 - (a) Simple Mail Transfer Protocol (SMTP)
 - (b) Internet Mail Access Protocol (IMAP)
 - (c) Post Office Protocol (POP)
 - (d) Hyper-Text Transfer Protocol (HTTP)
 - (e) all of the above

- 1 3. The Internet Protocol (IPv4) is an example of a:
 - (a) connection-less network layer protocol
 - (b) connection-oriented network layer protocol
 - (c) connection-less transport layer protocol
 - (d) connection-oriented transport layer protocol
 - (e) none of the above

- 1 4. According to the protocol specification, the maximum legal size of an IP packet is:
 - (a) 512 bytes
 - (b) 576 bytes
 - (c) 1024 bytes
 - (d) 1500 bytes
 - (e) 64 kilobytes

- 1 5. The transmission time required for sending a 512-Byte packet using a 56 kbps modem is:
- (a) about 7 milliseconds
 - (b) about 9 milliseconds
 - (c) about 40 milliseconds
 - (d) about 70 milliseconds
 - (e) about 90 milliseconds
- 1 6. The primary difference between iterated DNS queries and recursive DNS queries is:
- (a) iterated queries use port 53, while recursive queries use port 54
 - (b) recursive queries use port 53, while iterated queries use port 54
 - (c) iterated queries use UDP, while recursive queries use TCP
 - (d) recursive queries use UDP, while iterated queries use TCP
 - (e) none of the above
- 1 7. In the Transmission Control Protocol (TCP), acknowledgements (ACKs) are used for:
- (a) error control
 - (b) flow control
 - (c) congestion control
 - (d) error control and flow control
 - (e) error control, flow control, and congestion control
- 1 8. In typical implementations of TCP (e.g., TCP Reno), the types of ACKs used are always:
- (a) selective ACKs only
 - (b) a mix of selective ACKs and cumulative ACKs
 - (c) a mix of positive and negative ACKs
 - (d) positive, cumulative, lookahead ACKs
 - (e) delayed, cumulative, duplicate ACKs

Networking Concepts and Definitions

12 9. For each of the following pairs of terms, **define** each term, and make sure to **clarify** the key difference(s) between the two terms. Give an example, if appropriate.

(a) (3 marks) “circuit-switching” and “packet-switching”

(b) (3 marks) “internetwork” and “the Internet”

(c) (3 marks) “connection-less” and “connection-oriented”

(d) (3 marks) “pull protocol” and “push protocol”

Application Layer Protocols

- 10 10. Assume that a typical Web page on the Internet today consists of a base HTML file (about 6 kilobytes) and about 4 embedded objects (with a cumulative total of 12 kilobytes), which may come from the same Web server or from different Web servers.
- (a) (3 marks) In class, we argued that retrieving such a Web page using classic HTTP/1.0 would be “slow”. Why would it be slow? Identify at least three distinct inefficiencies that contribute to the delay.
- (b) (3 marks) Which of these inefficiencies are addressed by the “persistent connection” feature of HTTP/1.1? How effective would it be in this Web page scenario? Why?
- (c) (4 marks) In class, we identified at least three other mechanisms that could be used to reduce the latency for retrieving typical Web pages. List **any two** of these mechanisms, and comment briefly on their potential effectiveness (or not) for this particular Web page download scenario.

Domain Name Service (DNS)

- 10 11. The output on the following page was generated by running the `dig` command recently on `ict602c.cpsc.ucalgary.ca`. Use this output, and your knowledge of DNS, to answer as many of the following questions as you can.
- (a) (1 mark) What well-known port number is used for DNS queries?
 - (b) (1 mark) What is the IP address of `cs.usask.ca`?
 - (c) (1 mark) What is the IP address of the DNS server that answered the query in (b)?
 - (d) (1 mark) Was this response authoritative?
 - (e) (1 mark) How many mail servers are evident in the `cs.usask.ca` domain?
 - (f) (1 mark) What is the IP address of `cs.ubc.ca`?
 - (g) (1 mark) What is the IP address of the DNS server that answered the query in (f)?
 - (h) (1 mark) For how long can the query result from (f) be cached?
 - (i) (1 mark) Which of the two queries shown generated the faster response?
 - (j) (1 mark) Which of the two queries shown generated the larger response?

```
[carey@ict602c]$ dig cs.usask.ca
```

```
; <<>> DiG 9.7.3-RedHat-9.7.3-2.el6 <<>> cs.usask.ca
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 32104
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 4, ADDITIONAL: 0
;; QUESTION SECTION:
;cs.usask.ca.                IN      A
;; ANSWER SECTION:
cs.usask.ca.                12201  IN      A      128.233.101.16
;; AUTHORITY SECTION:
usask.ca.                   12201  IN      NS     hymie.usask.ca.
usask.ca.                   12201  IN      NS     access.usask.ca.
usask.ca.                   12201  IN      NS     delphi.usask.ca.
usask.ca.                   12201  IN      NS     zeppelin.sasknet.sk.ca.
;; Query time: 1 msec
;; SERVER: 136.159.2.9#53(136.159.2.9)
;; WHEN: Sat Feb 18 08:15:36 2012
;; MSG SIZE rcvd: 141
```

```
[carey@ict602c]$ dig cs.ubc.ca
```

```
; <<>> DiG 9.7.3-RedHat-9.7.3-2.el6 <<>> cs.ubc.ca
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 60274
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 2, ADDITIONAL: 2
;; QUESTION SECTION:
;cs.ubc.ca.                  IN      A
;; ANSWER SECTION:
cs.ubc.ca.                  3600   IN      A      142.103.6.5
;; AUTHORITY SECTION:
cs.ubc.ca.                  3600   IN      NS     fs1.ugrad.cs.ubc.ca.
cs.ubc.ca.                  3600   IN      NS     ns1.cs.ubc.ca.
;; ADDITIONAL SECTION:
fs1.ugrad.cs.ubc.ca.       3600   IN      A      198.162.35.1
ns1.cs.ubc.ca.             3600   IN      A      142.103.6.6
;; Query time: 195 msec
;; SERVER: 136.159.2.9#53(136.159.2.9)
;; WHEN: Sat Feb 18 08:18:03 2012
;; MSG SIZE rcvd: 117
```

Transmission Control Protocol

10 12. One of the unique features of TCP as a transport-layer protocol is its implementation of end-to-end congestion control. Although it was not part of the original TCP protocol design, congestion control was added in 1988 because of the inadequacies of network-layer congestion control in the Internet.

(a) (2 marks) What two new TCP sender state variables are used in TCP congestion control? What is the purpose of each of these state variables?

(c) (6 marks) What two new algorithms were added to provide TCP congestion control? What is the purpose of each? Give a brief overview of the operation of each.

(d) (2 marks) What is the fundamental underlying control principle during the steady-state operation of TCP congestion control? Why is this principle a good one?

*** THE END ***