**Remaining Time: 21 minutes, 04 seconds.**

Com **Question Completion Status:**

# Take Test: Exam 1 (Wed Mar 18)

## Test Information

Description This is an **online** exam for CS3700 that covers topics in HW#1 through HW#5.

**The duration of this Exam is 100 minutes.** A timer is set up for 105 minutes to force submission when the timer expires. Also, any test taking more than 100 minutes (but surely less than 105 minutes) may be subjected to a late penalty.

During the exam, **you are NOT allowed to use any software/hardware or browser other than the single browing window, in which you take the test, and a stand-alone calculator.** Once you start the test, if you try to leave the Browser window, in which you are taking the test, you are at risk of being forced by Blackboard to stop the exam without being able to resume it or retake it.

Instructions 1. Although now you are taking this exam online or even at home, you are still required to follow the same policies that was announced previously in my email and listed as below.

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a. Duration: **10:00AM ~ 11:40AM**, 100 minutes
b. Two sheets of scratch paper, which must be destroyed after the exam
c. No bathroom break
d. **NO software, browser (other than the window you use for your test), or any other resource is allowed**
e. You may not start the test at 10:15AM or later in order to take it.

3. As students, faculty, staff and administrators of Metropolitan State University of Denver, it is our responsibility to uphold and maintain an academic environment that furthers scholarly inquiry, creative activity and the application of knowledge. Please refer to CS3700 Course Policies for more details. Below are just a few highlights:

a. Act fairly towards others. For example, do not seek an unfair advantage over others by cheating with or by looking at other individual's work during examinations, or seeking for any information that is not included in your HANDWRITTEN review notes from any other resource or anybody else.
b. Do not share/show your exam work or any information related to the exam questions & answers to anyone else, regardless whether this person is in class or not.
c. Take group as well as individual responsibility for honorable behavior. Collectively, as well as individually, make every effort to prevent and avoid academic misconduct, and reports acts of misconduct that you witness.

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## QUESTION 1

**12 points** Saved

**Problem 1.** Socket programming using UDP and TCP services

**1.1** Fill in the blanks with the given Java statement(s) that accomplishes each given function in an application-layer program that uses TCP or UDP services. **The instances with the same name below are the same instance**, e.g., the socketB in (a) is the socketB created in (g).

(a)
```
ServerSocket socketA = new ServerSocket(8080);
Socket socketB = socketA.accept()
```

(b)
```
Socket socketC = new Socket("104.29.1.23", 8080);
```

(c)
```
DatagramSocket socketD = new DatagramSocket(4567);
```

(d)
```
PrintWriter outK = new PrintWriter(socketB.getOutputStream(), true);
outK.println("This is a test for CS3700");
```

(e)
```
PrintWriter outL = new PrintWriter(socketC.getOutputStream(), true);
outL.println("This is an Exam");
```

(f)
```
BufferedReader inE = new BufferedReader(new InputStreamReader(socketB.getInputStream()));
```

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d and e A client sends data to a server over a TCP connection.

b A server creates a TCP socket connection with a client in response to this client's connection request.

c Create a UDP socket.

**1.2** Fill in T (for true) or F (for false) for each of the following statements

**Caution**: in each blank, please fill ***one upper-case letter***: **T** or **F** without any extra character or symbol.

T (1) The socketC created in 1.1-(b) has a local IP 104.29.1.23 and a local port 8080.

T (2) In a program, socketA.accept() in 1.1-(a) can be called multiple times to return different sockets that all use local port 8080.

T (3) The socketD created in 1.1-(c) is connected to a remote datagram socket at a remote port 4567.

F (4) The socketD.receive( ) in 1.1-(h) is used to receive data from different sources via the same socket.

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T (1) In the persistent HTTP/1.1, the server and client may reuse the same TCP connection for more than one pair of HTTP messages.

T (2) A HTTP/1.1 response message may be sent by a HTTP client or server to respond a HTTP request message.

F (3) A status line and the “Host:” and “User-Agent:” header lines may be included in a HTTP/1.1 request message.

T (4) In HTTP/2, a 200 OK response message with body must be split into at least two frames encoded in binary format.

F (5) In HTTP/2, a stream is allowed to carry one or more messages, all of which must be sent on the same direction.

F (6) A SMTP server program responds to the commands such as HELO and QUIT coming from a SMTP client program.

T (7) SMTP may be used by the receiver’s user agent to pull an email from the receiver’s email server.

F (8) The SMTP server, not the SMTP client, sends out the first application-layer message once the TCP connection is established.

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**Question Completion Status:**

**Caution**: in each blank, please fill in the ***exact phrase*** given above without any extra character or symbol except for the single white space that is included in a phrase in between words, or missing or mis-spelling any character including the "." (case-sensitive please).

(1) When the ***authoritative server*** in charge of the ***.uvw.org*** domain changes its ip address, the TLD DNS server in charge of the .org domain needs to be notified to update its database.

(2) When a ***local DNS server*** in the ***abc.com*** domain doesn't have the ip address of ***www.uvw.org*** to be resolved in its cache, it needs to contact a root DNS server FIRST, a TLD DNS NEXT, but EVENTUALLY, gets such ip address from the authoritative DNS server in the abc.com domain.

(3) When a ***host*** within the ***.abc.com*** domain needs to visit the webserver named ***www.uvw.org***, this host needs to contact the local DNS server within the .abc.com domain to resolve the ip address of this webserver.

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| | Domain Name | IP |
|---|---|---|
| **root DNS server** | root.dns.net | A1.B1.C1.D1 |
| **TLD DNS server for the .org domain** | pri.tld.dns.org | A2.B2.C2.D2 |
| **Authoritative DNS server in the .xyz.org domain** | primary.dns.xyz.org | A3.B3.C3.D3 |
| **Local DNS server in the .xyz.org domain** | localPri.dns.xyz.org | A4.B4.C4.D4 |
| **Alias name of the web server in the .xyz.org domain** | www.xyz.org | |
| **Real name of a web server in the .xyz.org domain** | web.southUS.xyz.org | A5.B5.C5.D5 |
| **Real name of the mail server in the .xyz.org domain** | mailA.westUS.xyz.org | A6.B6.C6.D6 |

**Caution**: in each blank, please fill in the ***exact phrase*** given above without adding any extra character, symbol, or space character, or missing or mis-spelling any character including the "." (case-sensitive please).

(1) On the ***root DNS server***, the following resource records (RRs) must be stored in its RR database.

( primary.dns.xyz.org , A3.B3.C3.D3 , **NS**, TTL)

( pri.tld.dns.org , A2.B2.C2.D2 , **A**, TTL)

(2) On the ***local DNS server*** for the ***.xyz.org*** domain, the following RRs may be cached.

( primary.dns.xyz.org , A3.B3.C3.D3 , **CNAME**, TTL)

( web.southUS.xyz.org , **A5.B5.C5.D5**, CNAME , TTL)

( localPri.dns.xyz.ort , A3.B3.C3.D3 , **MX**, TTL)

*Click Save and Submit to save and submit. Click Save All Answers to save all answers.*

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packets are **much smaller** than RTT, there are always packets waiting for being transmitted, 8-bit sequence numbers are used, **window size N = 3**, **initial send_base = 27**, the sender has received acknowledgements to all the packets *before* **pkt27** and *hasn't* sent **pkt27** or any later packet yet, and the **Selective-Repeat** approach is used for reliable data transmission.

Between the moment when **pkt27 is sent** the first time by the sender and the moment when **ack31** is ***received by the sender*** the FIRST time, only the following abnormal loss/timeout events occur:

- **pkt29** is lost on the way when it is sent by the sender the FIRST time
- the timer for **pkt29** expires ***a while*** after **ack30** is received by the sender the FIRST time
- **ack31** is lost on the way when it is ***sent by the receiver*** the FIRST time
- the timer for **pkt31** expires ***a while*** after **ack#33** is received by the sender the FIRST time

**Hint**: BEFORE filling the short answers to the following questions, you are **highly recommended** to (1) **draw a graph on your scratch paper** to COMPLETELY illustrate the interaction between the sender and the receiver between the given moments, and 2) in this graph, on the sender's side, **illustrate the sender's window** for each ack receiving or timeout event. (no submission of the scratch paper though.)

**Caution**: You will be asked to fill the short answers to questions **(Q2) through (Q10)** for this **Problem 5** in the next 9 questions, i.e., **Problem 5.2 through Problem 5.10**.

**Caution**: **These questions are NOT necessarily listed in the order of the event occurrence time from earliest to latest.** Therefore, You need to use the graph you draw on your scratch paper to help you find when it occurs and what the actions are or what the window is.

**Problem 5.1** This is question **(Q1)** for **Problem 5**

**Hint**: Below is a word bank for the ***verbs*** that you may use for describing the ***actions***, but of course you need to pick one or multiple and decide the object(s)

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## QUESTION 6

**3 points** Save Answer

**Problem 5.2**. This is question **(Q2)** for **problem 5**.

**Hint**: Below is a word bank for the ***verbs*** that you may use for describing the ***actions***, but of course you need to pick one or multiple and decide the object(s).

**receive send re-send buffer deliver ignore discard**

**Caution**: **these questions are NOT necessarily listed in the order of the event occurrence time from earliest to latest.**

(**Q2**) Write down all the action(s) taken by the sender in response to **the event of receiving ack28**

Paragraph ▼ Arial ▼ 3 (12pt) ▼

Mashups

*Click Save and Submit to save and submit. Click Save All Answers to save all answers.*

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**Question Completion Status:**

## QUESTION 7

**3 points** Save Answer

**Problem 5.3**. This is question **(Q3)** for **problem 5**.

**Hint**: Below is a word bank for the ***verbs*** that you may use for describing the ***actions***, but of course you need to pick one or multiple and decide the object(s).

**receive send re-send buffer deliver ignore discard**

**Caution**: **these questions are NOT necessarily listed in the order of the event occurrence time from earliest to latest.**

(**Q3**) Write down all the action(s) taken by the sender in response to **the event of timeout(29), i.e., the timer for pkt29 expires**

Paragraph ▼ Arial ▼ 3 (12pt) ▼

Mashups

*Click Save and Submit to save and submit. Click Save All Answers to save all answers.*

**Remaining Time: 21 minutes, 04 seconds.**

**Question Completion Status:**

(**Q4**) Write down all the action(s) taken by the receiver in response to **the event of receiving pkt29** the FIRST time

Paragraph | Arial | 3 (12pt) | Mashups

## QUESTION 9

**3 points** Save Answer

**Problem 5.5**. This is question **(Q5)** for **problem 5**.

**Hint**: Below is a word bank for the ***verbs*** that you may use for describing the ***actions***, but of course you need to pick one or multiple and decide the object(s).

**receive send re-send buffer deliver ignore discard**

**Caution**: **these questions are NOT necessarily listed in the order of the event occurrence time from**

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**Remaining Time: 21 minutes, 04 seconds.**

**Question Completion Status:**

## QUESTION 10

**2 points** Save Answer

**Problem 5.6**. This is question **(Q6)** for **problem 5**.

**Caution**: **these questions are NOT necessarily listed in the order of the event occurrence time from earliest to latest.**

(**Q6**) Write down the sender's window ***right*** after the sender has taken all the action(s) in response to **the event of receiving ack29** the FIRST time (**hint**: 2, 3, [4, 5, 6], 7, 8 represents a sender's window with pkt4, pkt5, and pkt6 inside)

Paragraph ▼ Arial ▼ 3 (12pt) ▼

Mashups

*Click Save and Submit to save and submit. Click Save All Answers to save all answers.*

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**Question Completion Status:**

## QUESTION 11

**3 points** Save Answer

**Problem 5.7**. This is question **(Q7)** for **problem 5**.

**Hint**: Below is a word bank for the ***verbs*** that you may use for describing the ***actions***, but of course you need to pick one or multiple and decide the object(s).

**receive send re-send buffer deliver ignore discard**

**Caution**: **these questions are NOT necessarily listed in the order of the event occurrence time from earliest to latest.**

(**Q7**) Write down all the action(s) taken by the receiver in response to **the event of receiving pkt30** the FIRST time

Paragraph Arial 3 (12pt)

Mashups

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**Question Completion Status:**

Paragraph | Arial | 3 (12pt) | Mashups

## QUESTION 13

**3 points** Save Answer

**Problem 5.9**. This is question **(Q9)** for **problem 5**.

**Hint**: Below is a word bank for the ***verbs*** that you may use for describing the ***actions***, but of course you need to pick one or multiple and decide the object(s).

**receive send re-send buffer deliver ignore discard**

**Caution**: **these questions are NOT necessarily listed in the order of the event occurrence time from earliest to latest.**

(**Q9**) Write down all the action(s) taken by the sender in response to **the event of timeout(31), i.e., the**

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**Question Completion Status:**

## QUESTION 14

**3 points** Save Answer

**Problem 5.10**. This is question **(Q10)** for **problem 5**.

**Hint**: Below is a word bank for the ***verbs*** that you may use for describing the ***actions***, but of course you need to pick one or multiple and decide the object(s).

**receive send re-send buffer deliver ignore discard**

**Caution**: **these questions are NOT necessarily listed in the order of the event occurrence time from earliest to latest.**

(**Q10**) Write down all the action(s) taken by the sender in response to **the event of receiving ack31** the FIRST time

Paragraph ▼ Arial ▼ 3 (12pt) ▼

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Remaining Time: **21 minutes, 04 seconds.**

**Question Completion Status:**

## QUESTION 15

**20 points** Save Answer

**Problem 6**. Consider a packet of 3,000 bytes which begins at Host A and travels over two links to Host B. These two links are connected by one packet switch between Host A and Host B. The propagation speed on two links from Host A to Host B is $2\times10^6$m/s and $5\times10^6$ m/s, respectively. The transmission rate of each link is 10Mbps, respectively. A packet switch has a processing delay of 0.0003 second and an average queuing delay of 0.0005 second. The length of two links from Host A to Host B is 1 km and 2 km, respectively.

Fill your answers to the following questions in the text box below. **The answer to every question much be clearly labeled by the question number**, e.g. (Q1). Also, please do NOT include the answers to more than one question in each line, and of course you may use (and most likely will use) multiple lines to answer a question. (**NO point** will be given if it's not clearly which answer is for which question.)

**Some brief calculation steps/details and expressions are required for every question below in addition to the final answer**. (hint: don't forget the unit!)

(Q1) What is the ***end-to-end propagation delay*** from Host A to Host B for this packet?

(Q2) What is the ***transmission delay over the 1$^{st}$ link***, the link from Host A to Host B?

(Q3) the ***end-to-end transmission delay from Host A to Host B*** for this packet?

(Q4) What is the ***total end-to-end delay*** from Host A to Host B for this packet?

(Q5) If only considering the transmission delay over the two links by ***ignoring*** all the propagation, processing

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