Name of Candidate: ____________________________

Student ID: _____________________________________

Signature: ______________________________________

THE UNIVERSITY OF NEW SOUTH WALES

COMP3331/93331
Computer Networks and Applications
Sample Mid-session Examination

INSTRUCTIONS TO CANDIDATES:

(1) Time allowed: 1 hours 30 minutes (there is no separate reading time).
(2) Total number of pages: 5 (including this cover page).
(3) Total number of questions: 5. You must answer all questions. Questions are of different value. Marks are as indicated. This examination makes up **20 marks** of your final mark for this course.
(4) Do not write your answers on this paper. This paper *must be returned* at the end of the examination.
(5) Note that if the question asks you to derive a result or perform some calculations, it is important for you to show us your intermediate steps and tell us the arguments that you have made to obtain the result. You need to note that both the intermediate steps and the arguments carry marks. Please note that we are **not** just interested in whether you can get the final numerical answer or conclusion right, but we are **more** interested to find out whether you understand the subject matter. We do that by looking at your intermediate steps and the arguments that you have made to obtain the answer. Thus, if you can show us the perfect intermediate steps and the in-between arguments but got the numerical values wrong for some reason, we will still award you marks for having understood the subject matter.
If the question asks you to give an explanation, you should aim to give a succinct and to the point answer.
(6) This is a closed book exam. UNSW approved calculators are allowed.
(7) Write all answers in **ink** except where they are expressly required. Pencils may be used only for drawing, sketching or graphical work.
(8) For **Questions 2 – 5**, if you do not wish your answer for a question to be marked, write **0.5 SYMPATHY MARK PLEASE** in the answer booklet for the question. If you do this you will be awarded 0.5 sympathy mark and your answer for that question will not be marked.

GOOD LUCK

Question 1 Short Answer (2 marks)

(a) Give one reason that DNS lookups are run over UDP rather than TCP.

(b) Give one reason that streaming multimedia is run over UDP rather than TCP.

(c) Which DNS record type provides the authoritative name server associated with a given domain?

(d) Consider the following fragment of a traceroute output:

1 vlan385.gaszr1.gw.unsw.EDU.AU (129.94.242.1) 1.519 ms 1.640 ms 1.850 ms

2 129.94.6.122 (129.94.6.122) 0.495 ms 0.499 ms 0.491 ms

3 129.94.39.17 (129.94.39.17) 1.230 ms 1.233 ms 1.225 ms

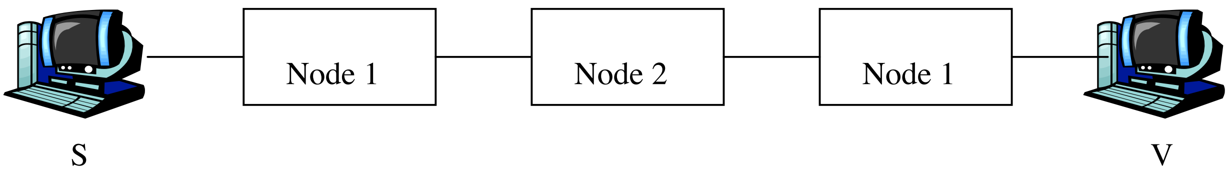
4 ombudnex1-vl-3154.gw.unsw.edu.au (149.171.253.35) 2.202 ms libudnex1-vl-3154.gw.unsw.edu.au (149.171.253.34) 53.589 ms ombudnex1-vl-3154.gw.unsw.edu.au (149.171.253.35) 2.187 ms

5 nswbr1-te-8-1.gw.unsw.edu.au (149.171.255.105) 1.428 ms 1.205 ms 1.208 ms

Can you explain what happened at the fourth hop?

Question 2 (4 marks)

In this problem we will compare the performance of circuit switching with datagram packet switching. Figure shows a source host S and a destination host V connected by a switching network consisting of three nodes. We will make the following assumptions:

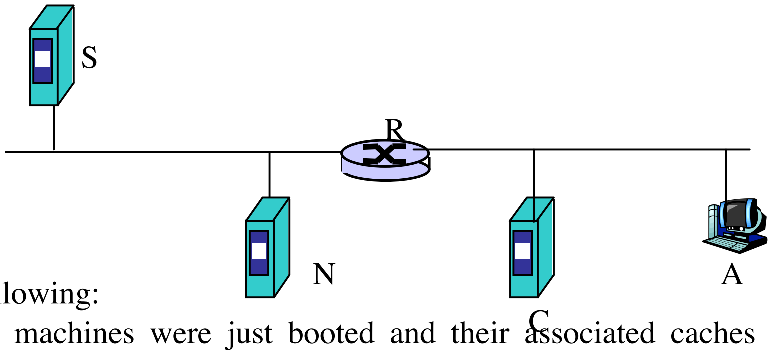


a. The transmission rate of all the links is 9600 bits per second.
b. The propagation delay in each hop is 0.001 seconds.
c. The size of the message that needs to be sent from S to D is 3200 bits.
d. The end-to-end connection setup time for circuit switching is 0.2 seconds.
e. For packet switching the packet size is 824 (this includes 24 bits of header).
f. Assume that for packet switching there is no queuing and processing delay at the intermediate nodes.
g. Assume that no acknowledgements are required.

Find the time to send the message from the source to the destination assuming that the network uses (i) circuit switching and (ii) packet switching. Show all calculations.

Question 3. (5 marks)

In the topology shown below, machine A is a desktop client running a Web browser. S is a Web server hosting the requested Web page. N is the local name server for the local network but not the authoritative name server for S. R is a router and C is a Web cache. Client A is configured to use the Web cache for all requests (assume that the client is configured with the IP address of the cache and that it sends all HTTP requests directly to the cache). All wires/links are Ethernet segments.



Assume the following:

- All the machines were just booted and their associated caches (DNS and Web) are all empty.
- http://S/index.html fits in a single packet.
- Persistent HTTP connections are used among A, C and S (i.e., you should assume that once any connection between these hosts is established it is never closed).
- Web caches respond to TCP requests that look like packet # 2 in the table below (e.g., GET http://abc.com/index.html)

Part 1

The user on machine A opens the browser and types in http://S/index.html in the browser window. The table below shows a number of messages sent/received in servicing this request. Note that this is not necessarily a complete list of all packets. In addition, there are a few bogus packets that are never sent/received. The packets are not listed in the order that they are sent/received (i.e. they are not in temporal order). Your job is to fill in the order column (rightmost column) to indicate the order in which each packet was sent/received (1=first, 2=second, etc). Place an X in the order column if you think that the packet in that particular row is bogus. Note that some entries for the source and destination port number are left blank. This is because the OS on the local host determines the choice of these ports randomly.

ID	Source	Destination	Source Port	Destination Port	Protocol	Contents	Order
1	C	DNS root server		DNS (53)	UDP	DNS type A query for S	
2	A	C		Web Cache	TCP	GET http://S/index.html	
3	N	DNS root server		DNS (53)	UDP	DNS type A query for S	
4	C	S		HTTP (80)	TCP	SYN	
5	C	S		HTTP (80)	TCP	GET index.html	
6	S	A	HTTP (80)		TCP	index.html	
7	C	A	Web cache		TCP	index.html	
8	N	C	DNS (53)		UDP	IP address for S	
9	S	C	HTTP (80)		TCP	index.html	
10	N	A	DNS (53)		UDP	IP address for S	
11	A	S		HTTP (80)	TCP	GET index.html	

NOTE: DO NOT FILL IN THE TABLE IN THE QUESTION PAPER. DRAW THE TABLE IN YOUR ANSWER BOOKLET AND FILL IN THE ORDER COLUMN IN THIS TABLE. YOU DO NOT HAVE TO COPY THE ENTIRE TABLE IN YOUR ANSWER BOOKLET. IT IS SUFFICIENT TO JUST HAVE THE *ID* AND *ORDER* COLUMNS IN YOUR ANSWER.

Part 2

Assume that the client A has no local Web or DNS caches (i.e. client A cannot cache Web pages and DNS records). Similarly assume that the Web cache C has no DNS cache. However, all other cacheable things are cached. Now assume that the user on machine A types in http://S/index.html in the browser window immediately after the previous request for the same page (i.e immediately after Part 1). Which of the valid messages (i.e. the messages that you have not marked as X) in the table would be eliminated. You may indicate these messages using their corresponding IDs.

Question 4 (3 marks)

Two hosts A and B are using the Go-Back-N protocol with window size of 4. Host A sends host B four segments with sequence numbers 15,16,17 and 18. These segments arrive at host B in the following order: 15, 18, 17, 16. When host B receives each of these segments, it sends an acknowledgment segment to host A. What are the sequence numbers in the acknowledgement segments that host B sends to host A in the order in which host B sends them?

Repeat the above if the two hosts are using selective-repeat protocol.

Question 5 (6 marks)

Figures 1 and 2 (on Page 5) show, respectively, the finite state machine (FSM) of the rdt3.0 sender and rdt2.2 receiver as discussed in the text. It is known that the combination of rdt3.0 sender and rdt2.2 receiver will produce a reliable stop-and-wait transport protocol that can deal with both packet loss and packet corruption.

Answer the following questions:

(a) Assuming (i) the sender has only one data packet to be sent; (ii) the data packet is lost the first time it is sent but after that, the system works perfectly such that no other packets (i.e. data or ACK packets) will be lost nor corrupted. Describe the actions taken by the sender and receiver to realise the reliable delivery of this data packet. Your description should include the states of the sender and receiver, how they make their decisions and the actions taken by them (i.e. what conditions are satisfied and therefore what actions are taken). Your description should end with the sender receiving an uncorrupted ACK from the receiver.

(b) Assuming (i) the sender has two data packets to send to the receiver; (ii) the first data packet has been correctly received by the receiver and the corresponding ACK has also been correctly received by the sender; (iii) the second data packet is corrupted but after that, the system works perfectly that no other packets will be lost or corrupted. Describe the actions taken by the sender and receiver to realise the reliable delivery of the second data packet. Your description should include the states of the sender and receiver, how they make their decisions and the actions taken by them (i.e. what conditions are satisfied and therefore what actions are taken). Your description should end with the sender receiving an uncorrupted ACK from the receiver.

(c) As mentioned earlier, the sender and receiver shown in Figures 1 and 2 can deal with both packet loss and packet corruption. For this part, we will assume that the only form of unreliability between the sender and receiver is that data packets can be lost. In other words, the following forms of unreliability will not occur: the corruption of data or ACK packets, and the lost of ACK packets. Under these assumptions, explain whether it is still necessary for a stop-and-wait protocol to use sequence numbers.

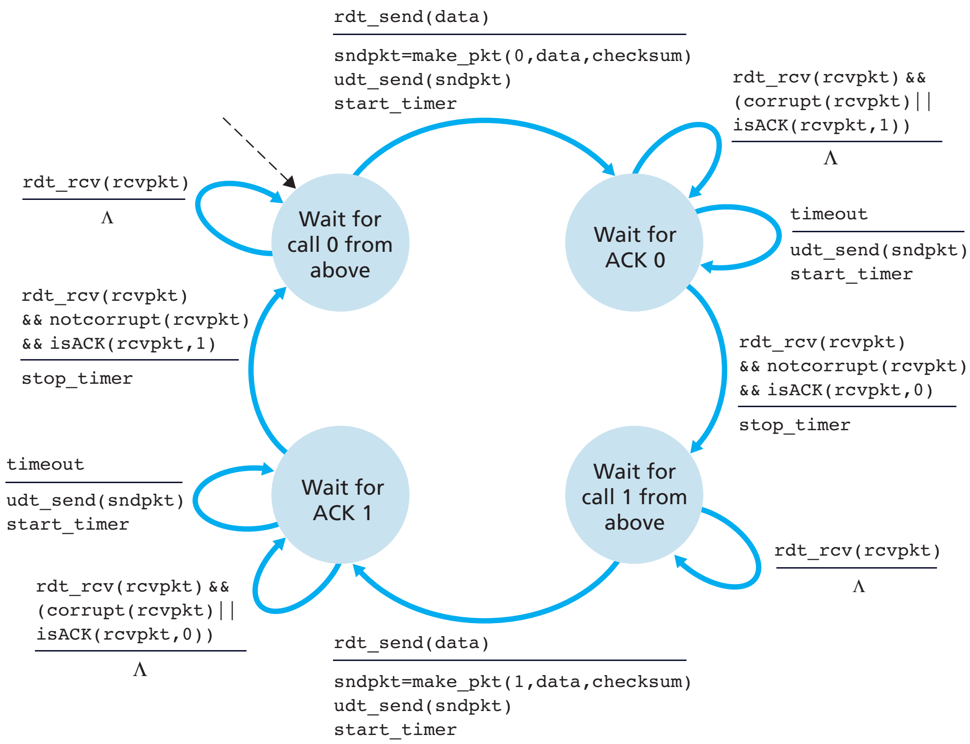


Figure 3.15 ♦ rdt3.0 sender

Figure 1

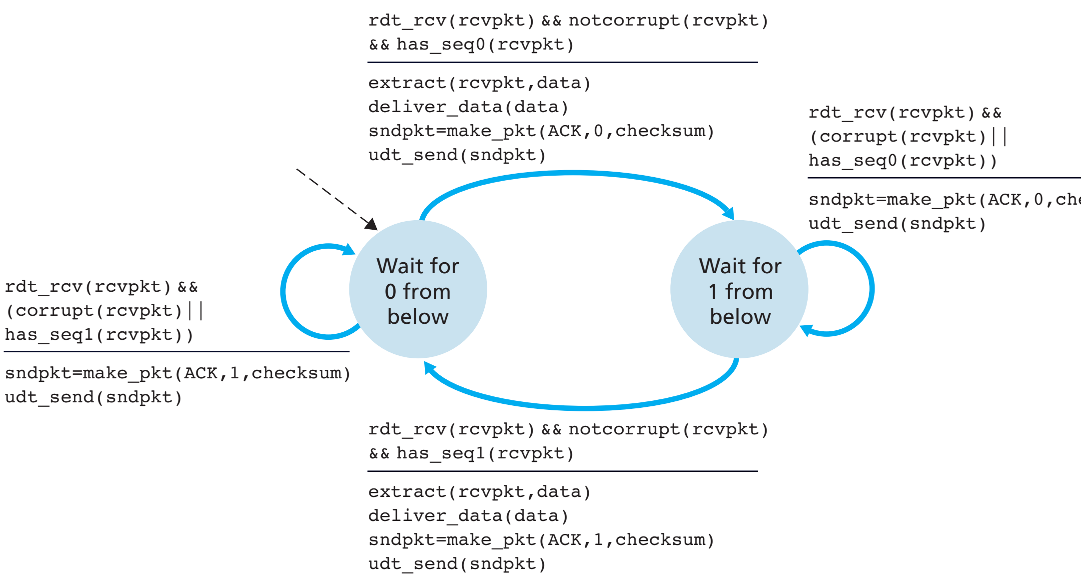


Figure 3.14 ♦ rdt2.2 receiver

Figure 2

END OF EXAM