The University of Queensland
School of Information Technology and Electrical Engineering
Semester Two, 2011

COMS3200 / COMS7201 – Assignment Two (Draft)

Due: 4pm Monday October 10, 2011

Weighting: 17% of final grade

Q1 2 marks for each part
Part marks if some correct working

Q1. Packet length = 1025 bytes
= 8200 bits

ACK = 25 bytes = 200 bits

Tx = Transmission time packet = 8.2 μs

Tx-ack = " " ACK. 0.2 μs

MAX SEQ NO = $2^6 - 1 = 63$, SEQ NUMS = $2^6 = 64$

a) – c) Prop time = 50 km @ 200,000 km/s
= 50 km @ 5 μs/km.
= 250 μs.

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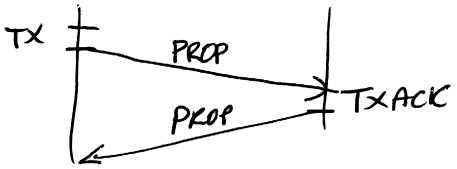
a)



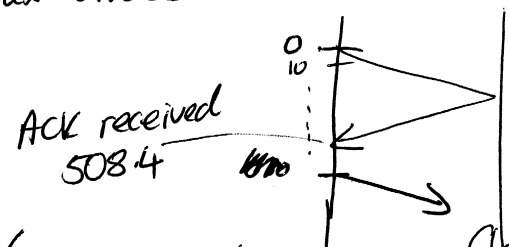
RTT = TX + PROP × 2 + TX ACK
= 8.2 + 500 + 0.2
= 508.4 μs

Payload = 8000 bits

Data Rate = $\frac{8000\ b}{508.4\ \mu s}$ = 15.7366 Mbps
≈ 15.7 Mbps.

(b) Go-back-n,

Max Unack. Packets = SEQ NUMS − 1 = 63



63rd packet send after 516.6 μs

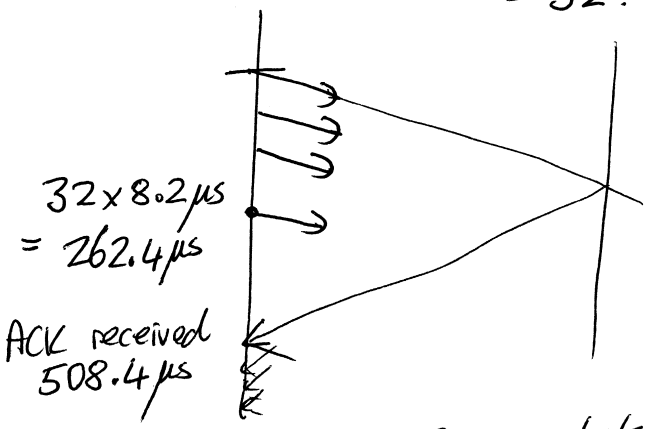
So can run at full rate (no wait)

⇒ $\frac{8000\ bits}{8200\ bits} \times 1\ Gbps$ = 975.6 Mbps

Q1 (c)

Selective-Repeat

Max Unack. packets = MaxSeq/2
= 32.



So can send 32 packets every 508.4 μs

$\Rightarrow \frac{32 \times 8000\ b}{508.4\ \mu s} = 503.54$ Mbps
$\approx$ 504 Mbps.

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d-f 200m, TX = 1μs

RTT = 8.2μs + 1μs + 0.2 + 1μs
= 10.4μs.

d) Stop & Wait — $\frac{8000\ bits}{10.4\ \mu s} = 769.2$ Mbps.

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e) Can run at full rate, as per (b)
975.6 Mbps

f) Can run at full rate 975.6 Mbps

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[1] g) Prop time = 5μs

RTT = 8.2 + 5 + 0.2 + 5

= 18.4μs.

But no NAK, so wait for timeout

⇒ 8.2μs + 1000μs

= ~~10008~~ 10008.2μs

[1000μs or 1ms also OK.]

h) Send a NAK when second packet received.

⇒ 8.2μs + 8.2μs + 5 + 0.2 + 5

= 26.6μs.

So retx starts at 26.6μs

[or if no NAK assumed, then 1008.2μs or 1ms]

i) ~~R~~ Send a NAK when second packet received.

⇒ 26.6μs

i) Ethernet does <u>not</u> use reliable protocol.

Q2

Field	Value in Hexadecimal + Explanation for any values shown as ????
Source Port	0050
Destination Port:	0190
Sequence Number	???? Chosen by host 2 to not overlap any sequence number used for same connection in past 120 seconds
Acknowledgement number	1096
TCP Header Length	6
CWR	0
ECE	0
URG	0
ACK	1
PSH	0
RST	0
SYN	1
FIN	0
Window Size	0400
Checksum	???? based on one's complement sum of pseudoheader
Urgent pointer	0
First 32-bit Option Word	03 03 0A 00

2 marks for Seq num + explanation;
2 marks for Checksum + explanation,
2 marks for option word
1 mark for all others

Q2

	Sender (MAC Address) [IP Address]	**Receiver(s) (MAC Address) [IP Address]**	**Contents:**
1	B (m6) [192.31.67.6]	Broadcast (FFFFFFFFFFFF) [192.31.67.5]	ARP request: ”Who owns IP address 192.31.67.5? My IP address is 192.31.67.6” (Host B needs to find the MAC address of the DNS server.)
2	A (m5) [192.31.67.5]	B (m6) [192.31.67.6]	B says “I own 192.31.67.6, my MAC is m5”
3	B (m6) [192.31.67.6]	A (m5) [192.31.67.5]	UDP – DNS Request, what is the IP of www.domain.com
4	A (m5) [192.31.67.5]	B (m6) [192.31.67.6]	UDP – DNS Reply, www.domain.com is 192.31.65.2
5	B (m6) [192.31.67.6]	Broadcast (FFFFFFFFFFFF) [192.31.67.1]	ARP request: ”Who owns IP address 192.31.67.1? My IP address is 192.31.67.6” (Host B needs to find the MAC address of the Router.)
6	Router (m4) [192.31.67.5]	B (m6) [192.31.67.6]	Router says “I own 192.31.67.1, my MAC is m4
7	B (m6) [192.31.67.6]	D via Router (m5) [192.31.65.2]	B sends TCP-SYN to Port 80 of D to start TCP segment, it needs to go via the router
8	Router (m3) [192.31.65.1]	Broadcast (FFFFFFFFFFFF) [192.31.65.2]	ARP request: ”Who owns IP address 192.31.65.2? My IP address is 192.31.65.1” (Router needs to find the MAC address of D.) Everybody also now knows the router’s MAC.
9	D (m2) [192.31.65.2]	Router (m3) [192.31.65.1]	D says “I own 192.31.65.2, my MAC is m2”
10	Router (m3) [192.31.67.6]	D (m2) [192.31.65.2]	Router forwards TCP SYN to Port 80 of D to start TCP segment from B
11	D (m2) [192.31.65.2]	B via Router (m3) [192.31.67.6]	D responds to TCP SYN with SYN + ACK, needs to go to B via router
12	Router (m4) [192.31.65.2]	B (m6) [192.31.67.6]	

13	B (m6) [192.31.67.6]	D via Router (m4) [192.31.65.2]	B responds to TCP SYN + ACK, with ACK needs to go to D via router Link now established
14	Router (m3) [192.31.67.6]	D (m2) [192.31.65.2]	
15	B (m6) [192.31.67.6]	D via Router (m4) [192.31.65.2]	HTTP "GET" sent in TCP packet to D via Router
16	Router (m3) [192.31.67.6]	D (m2) [192.31.65.2]	
17	D (m2) [192.31.65.2]	B via Router (m3) [192.31.67.6]	TCP ACK for HTTP GET is sent back to B This could be piggybacked on the following http reply if the reply is fast.
18	Router (m4) [192.31.65.2]	B (m6) [192.31.67.6]	
19	D (m2) [192.31.65.2]	B via Router (m3) [192.31.67.6]	HTTP REPLY containing webpage in TCP packet. Could include above ACK.
20	Router (m5) [192.31.65.2]	B (m6) [192.31.67.6]	
21	B (m6) [192.31.67.6]	D via Router (m4) [192.31.65.2]	ACK for HTTP reply
22	Router (m3) [192.31.67.6]	D (m2) [192.31.65.2]	
23	B (m6) [192.31.67.6]	D via Router (m4) [192.31.65.2]	Now close the connection, TCP - FIN sent from B to D via router
24	Router (m3) [192.31.67.6]	D (m2) [192.31.65.2]	
25	D (m2) [192.31.65.2]	B via Router (m3) [192.31.67.6]	TCP –ACK from D to B in response to FIN
26	Router (m5) [192.31.65.2]	B (m6) [192.31.67.6]	

27	B (m6) [192.31.67.6]	D via Router (m4) [192.31.65.2]	TCP –FIN from D to B to close the connection. This (+25/26) would often be sent as a single packet.
28	Router (m3) [192.31.67.6]	D (m2) [192.31.65.2]	
29	B (m6) [192.31.67.6]	D via Router (m4) [192.31.65.2]	Now complete the connection closure, TCP - ACK sent from B to D via router
30	Router (m3) [192.31.67.6]	D (m2) [192.31.65.2]	.

1 mark each, 0.5 marks if one minor error, such as wrong MAC or IP address