NWEN302 Assignment 4

Question One: Transport for Routing

a) **Why is OSPF carried over "raw" IP? (Explain why it does not need a transport layer protocol.)**
OSPF needs to talk to multiple neighbours on the same network segment, using multicasting. TCP does not support multicasting and UDP is not a reliable protocol. Thus OSPF has its own implementation of a transport mechanism.

b) **Without a transport layer protocol, how does OSPF deal with reliability?**
Link state acknowledgement messages provide reliability to the link-state exchange process, by explicitly acknowledging receipt of a Link State Update message.

c) **Why is BGP carried over TCP?**
Mainly for convenience, at the time of BGP's creation TCP was already out there, and because BGP is essentially another application layer protocol to the TCP/IP stack. BGP also does not provide its own security mechanism, relying on the TCP option to facilitate it. And it also uses unicasts to advertise to each of its adjacent neighbours, in contrast to interior routing protocols which usually use multicasts for efficient communication.

Question Two: Network Layer Forwarding

Using Reverse Path Forwarding means that R3 will look at the paths that the incoming packet could have taken to arrive and will see that the packet arriving through m1 matches the source ip in the packet and choose to forward that packet on to the rest of the network.

Question Three: Link State Routing

Step	N'	D(t),p(t)	D(u),p(u)	D(v),p(v)	D(w),p(w)	D(y),p(y)	D(z),p(z)
0	x	∞	∞	3, x	6, x	6, x	8, x
1	xv	7, v	6, v		6, x	6, x	8, x
2	xvy	7, v	6, v		6, x		8, x
3	xvyu	7, v			6, x		8, x
4	xvyuw	7, v					8, x
5	xvyuwt						8, x
6	xvyuwtz						

Question Four: Distance Vector Routing

Initial state of B

Destination	Distance	Next Hop
A	2	A
B	0	B
C	5	C
D	∞	-
E	4	E
F	∞	-
G	∞	-

B receives Distance vectors from A, C and E

From A	From C	From E
0	∞	∞
2	5	4
∞	0	∞
3	∞	5
∞	∞	0
∞	4	2
∞	3	∞

B calculates the minimum of the paths to nodes based on these distance vectors and creates a new routing table from these vectors.

Cost of reaching A from B: min { 2+0, 5+∞, 4+∞} = 2 via A
Cost of reaching C from B: min { 2+∞, 5+0, 4+∞} = 5 via C
Cost of reaching D from B: min { 2+3, 5+∞, 4+5} = 5 via A
Cost of reaching E from B: min { 2+∞, 5+∞, 4+0} = 4 via E
Cost of reaching F from B: min { 2+∞, 5+4, 4+2} = 6 via E
Cost of reaching G from B: min { 2+∞, 5+3, 4+∞} = 8 via C

New Table created from Distance Vectors:

Destination	Distance	Next Hop
A	2	A
B	0	B
C	5	C
D	5	A
E	4	E
F	6	E
G	8	C

Question Five: TCP

a) i) 110-90 = 20
   ii) the acknowledgement number will be the first segment of the sequence number, 90.

b) i) 10^6 x 0.15 / 8 * 1.5 * 10^3 = 125 segments
   ii) Average Window size is 2*125 segments /3 = 83.33333 = 84 segments
   Average Throughput is 84 segments * 1500bytes*8 / 0.15seconds = 6.72 Mbps
   iii) (84 segments/ 2) * 0.15 seconds = 6.3 seconds

Question Six: TCP

a) TCP1 is using Tahoe as it sets the Congestion window size to 1 MSS, Reno is TCP2 as the Congestion window size is set to half, both of these are done after receiving 2 duplicate ACKs and performing a fast retransmit.

b) The connection B-Y takes the most time (50ms) and TCP1 is shown to be the more time consuming connection (taking twice as long to process)

c) The benefit is that reno will skip the slow start phase used by tahoe after the fast retransmit, and enters a different phase called fast recovery instead. In both algorithms if an ACK times out, slow start is used and both algorithms reduce the congestion window to 1MSS. Reno sets halves the congestion window then sets the slow start threshold to the congestion window size, whereas Tahoe will sets the slow start threshold to half of the congestion window then sets the congestion window to half.

d) The ssthresh is 32 segments, as in the graph this is when both reno and tahoe begin to slow down.

e) this allows the receiver to tell the sender how much unacknowledged data can be in flight