Started on	Wednesday, 23 September 2020, 8:16 PM
State	Finished
Completed on	Wednesday, 23 September 2020, 9:08 PM
Time taken	51 mins 38 secs

Information

The following description provides relevant information for answering the questions on this page.

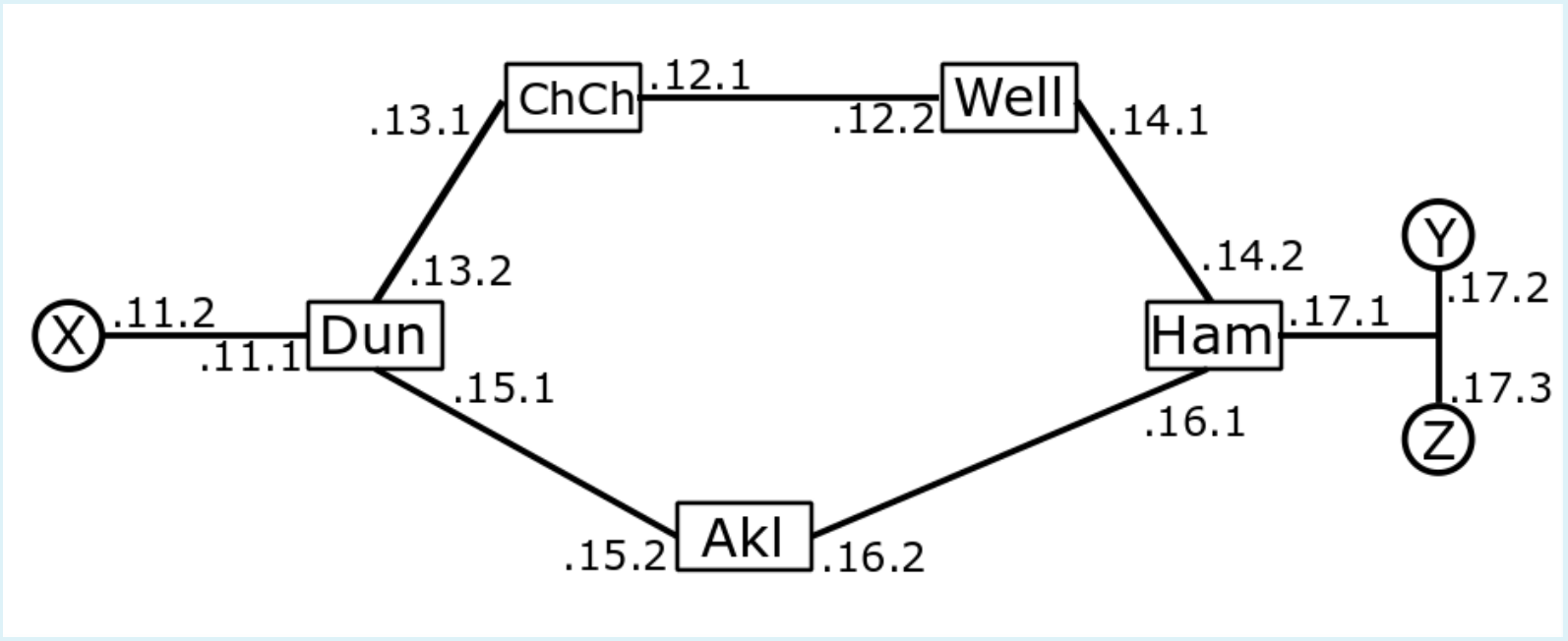

Figure 1

Consider the network above, routers are indicated by rectangles, end-hosts by circles. Assume that all the networks are /24 networks. We give for all the network addresses only the last two bytes.
Suppose the routers *Ham* and *Akl* have been configured with the following routing tables:

Ham

Destination	Next hop gateway
.14.0	*
.16.0	*
.17.0	*

Auckland

Destination	Next hop gateway
.15.0	*
.16.0	*
.17.0	.16.1

where the asterisk * refers to a directly attached network

Please answer the questions on this page using the above description.

Question **1**

Correct

Marked out of 4.00

Suppose a user at router *Akl* enters the command ping .17.2 and the routing table of host *Y* is completely empty. What will happen?

(penalty regime: 50, 100 %)

Select one:

- a. *Akl* reports Destination host unreachable
- b. *Akl* receives destination port not reachable
- c. *Akl* receives no answer ✔ Correct, packets will reach *Y* although *Y* cannot send a response as its forwarding table is empty
- d. *Akl* reports network unreachable

Your answer is correct.

Question **2**

Correct

Marked out of 4.00

Please give the *minimum* routing table for *Y* to make the previous question work?

(penalty regime: 50, 100 %)

Select one:

- a. Default route to *Ham* matching 0.0.0.0/0 ✔ Correct, as *Y* is only a host rather than a router it only needs to add a default route to *Ham*
- b. Add forwarding rules to each member of the network
- c. Correctly configure routing table of *Ham*, so it can route *Y*s packets correctly
- d. Add forwarding rules for each of the routers

Your answer is correct.

Question **3**

Correct

Marked out of 4.00

Suppose that the user at router *Akl* enters the command ping .*12.2*. What will happen?

(penalty regime: 50, 100 %)

Select one:

- a. *Akl* reports destination host not reachable
- b. *Akl* reports network unreachable ✔ Correct, *Akl* has no matching flow table entry for .12.2
- c. *Akl* receives no response
- d. *Akl* receives destination net unreachable

Your answer is correct.

Question **4**

Correct

Marked out of 14.00

Please give complete routing tables for **all** the routers, such that each host/router can reach all of the given networks, each router has only one entry per destination network, all routes require the minimum number of hops, and the routing tables of the hosts have just two entries.

Enter the only the last two bytes of the address of the next hop gateway, as they are written in Figure 1. Directly attached networks should be represented by *.

If there are two routes with the same minimum number of hops then you can choose either one.

Enter these into the following tables with the header corresponding to the router

Akl

Destination	Next hop gateway
.11.0	15.1 ✔
.12.0	15.1 ✔
.13.0	15.1 ✔
.14.0	16.1 ✔
.15.0	*
.16.0	*
.17.0	.16.1

Ham

Destination	Next hop gateway
.11.0	16.2 ✔
.12.0	14.1 ✔
.13.0	14.1 ✔
.14.0	* ✔
.15.0	16.2 ✔
.16.0	* ✔
.17.0	* ✔

Well

Destination	Next hop gateway
.11.0	12.1 ✔
.12.0	* ✔
.13.0	12.1 ✔
.14.0	* ✔
.15.0	12.1 ✔
.16.0	14.2 ✔
.17.0	14.2 ✔

Chch

Destination	Next hop gateway
.11.0	13.2 ✔
.12.0	* ✔
.13.0	* ✔
.14.0	12.2 ✔
.15.0	13.2 ✔
.16.0	12.2 ✔
.17.0	12.2 ✔

Dun

Destination	Next hop gateway
.11.0	* ✔
.12.0	13.1 ✔
.13.0	* ✔
.14.0	13.1 ✔
.15.0	* ✔
.16.0	15.2 ✔
.17.0	15.2 ✔

(penalty regime for each text box: 50, 100 %)

Question **5**

Correct

Marked out of 2.00

How many hops are needed from host *X* to host *Y*?

(penalty regime: 50, 100 %)

Answer: 4 ✔

Correct

Question **6**

Correct

Marked out of 2.00

How many hops are needed from router *ChCh* to Router *Ham*?

(penalty regime: 50, 100 %)

Answer: 2 ✔

Correct

Information

The following description provides relevant information for answering questions 7 and 8
Below is a network of nodes connected by weighted edges.

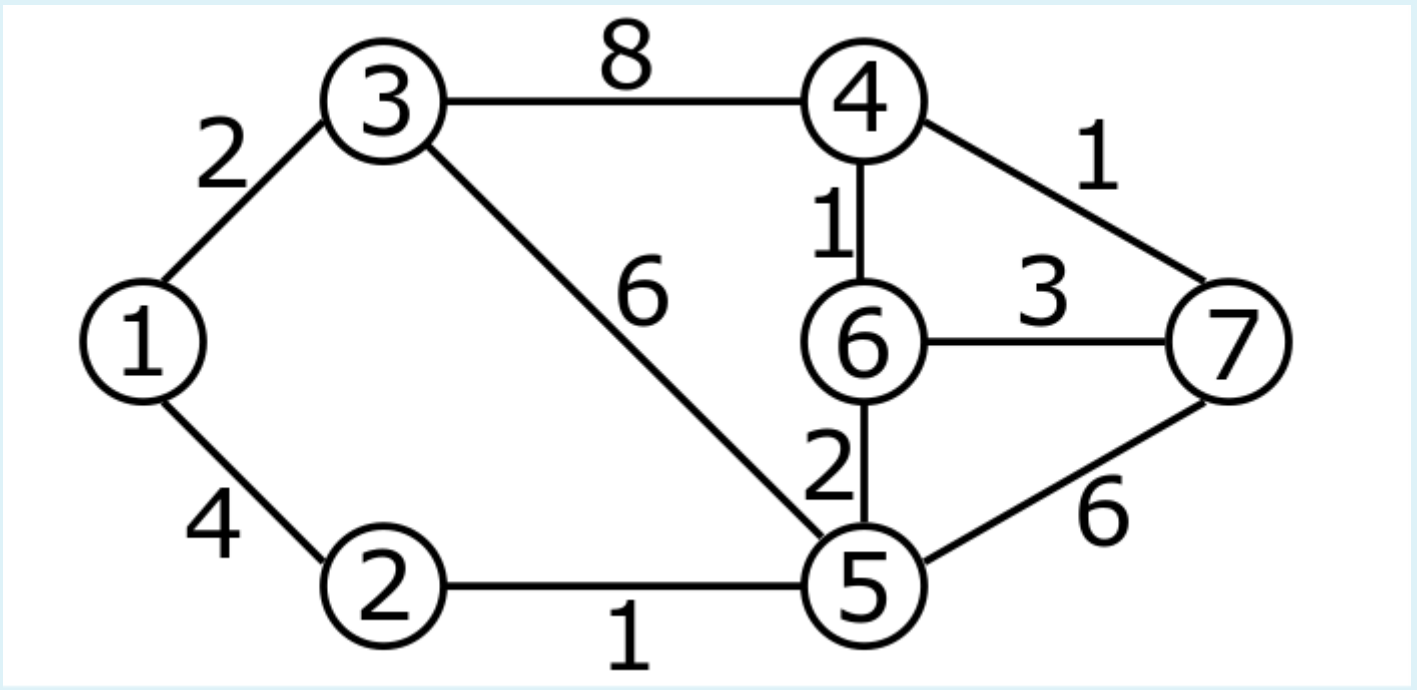

Figure 2

Please answer the following questions 7 and 8 using the above description.

Question **7**

Correct

Marked out of 11.00

Apply the Bellman-Ford routing algorithm to the figure shown at the top of the page to find the minimum cost routes from station 1 to all other stations. Please fill in the following table with the calculation steps.
Please use "inf" to specify an infinite cost and "-" to specify no next hop.

Bellman-Ford Algorithm Results for station 1

Station	1-Hop (cost, next-hop)	2-Hop (cost, next-hop)	3-Hop (cost, next-hop)	4-Hop (cost, next-hop)	5-Hop (cost, next-hop)
1	0,1	0,1	0,1	0,1	0,1
2	4 ✔ , 2 ✔	4 ✔ , 2 ✔	4 ✔ , 2 ✔	4 ✔ , 2 ✔	4 ✔ , 2 ✔
3	2 ✔ , 3 ✔	2 ✔ , 3 ✔	2 ✔ , 3 ✔	2 ✔ , 3 ✔	2 ✔ , 3 ✔
4	inf,-	10 ✔ , 3 ✔	10 ✔ , 3 ✔	8 ✔ , 2 ✔	8 ✔ , 2 ✔
5	inf,-	5 ✔ , 2 ✔	5 ✔ , 2 ✔	5 ✔ , 2 ✔	5 ✔ , 2 ✔
6	inf,-	inf,-	7 ✔ , 2 ✔	7 ✔ , 2 ✔	7 ✔ , 2 ✔
7	inf,-	inf,-	11 ✔ , 2 ✔	10 ✔ , 2 ✔	9 ✔ , 2 ✔

(penalty regime per text box: 50, 100 %)

Question **8**

Correct

Marked out of 11.00

Apply Dijkstra's algorithm on the example network Figure 2 to find the minimum cost routes from station 1 to all other stations. Please fill in the following table for the values during calculation steps. S is the set of stations whose least-cost path is known; D(v) is the current cost of path from source (i.e., station 1) to station v; p(v) is the predecessor station along path from source to v, that is next to v.
Please use "inf" to specify an infinite cost and "-' to specify no predecessor.

Dijkstra Algorithm Results for station 1

Step	S	D(2), p(2)	D(3), p(3)	D(4), p(4)	D(5), p(5)	D(6), p(6)	D(7), p(7)
0	{1}	4 , 1	2 , 1	inf , -	inf , -	inf , -	inf , -
1	{13}	4 , 1	2 , 1	10 , 3	8 , 3	inf , -	inf , -
2	{132}	4 , 1	2 , 1	10 , 3	5 , 2	inf , -	inf , -
3	{1325}	4 , 1	2 , 1	10 , 3	5 , 2	7 , 5	11 , 5
4	{13256}	4 , 1	2 , 1	8 , 6	5 , 2	7 , 5	10 , 6
5	{132564}	4 , 1	2 , 1	8 , 6	5 , 2	7 , 5	9 , 4
6	{1325647}	4 , 1	2 , 1	8 , 6	5 , 2	7 , 5	9 , 4

(penalty regime: 50, 100 %)

Question **9**

Correct

Marked out of 2.00

Suppose we have a network whose routers have a low memory capacity. What would be the best type of routing protocol?

(penalty regime: 100 %)

Select one:

- a. Link-state (Dijkstra's algorithm)
- b. Distance-vector (Bellman-Ford) ✔ Correct, routers in a distance-vector protocol only need to store a direction rather than a full topology.

Your answer is correct.

Question **10**

Correct

Marked out of 3.00

Suppose we have a large network of routers (greater than 1,000) and many more links. What would be the best type of routing protocol and why?

(penalty regime: 50, 100 %)

Select one:

- a. Distance-vector, because link failure has fast convergence over the network
- b. Link-state, because flooding works faster with more nodes
- c. Distance-vector, because information is shared only among neighbors ✔ Correct, distance-vector only has to store a direction rather than the full path
- d. Link-state, because having the full topology allows faster recovery from link/node failure

Your answer is correct.

Question **11**

Correct

Marked out of 3.00

Suppose we have a network with a few faulty links that may disconnect and reconnect at any time. Which routing protocol would be the best and why?

(penalty regime: 50, 100 %)

Select one:

- a. Distance-vector, since routing information is only shared among neighbors, thus less information is lost.
- b. Link-state, since flooding won't be stopped after losing a single link
- c. Link-state, since specific updates to the link table can be flooded ✔ Correct, less updates are needed to bring the link-state up to date, and these are disseminated faster through flooding
- d. Distance-vector, since this update only concerns hosts connected by that link

Your answer is correct.

Information

Consider a frame consisting of two characters of eight bits each. Assume that the bit error probability / rate is 10^{-2} and that bit errors are independent for each bit.

Please answer questions 12-15 using the description above.

Question **12**

Correct

Marked out of 3.00

What is the probability that the frame contains at least one error? Write your answer to 4 decimal places with no rounding.

(penalty regime: 50, 100 %)

Answer: 0.1485 ✔

Question **13**

Correct

Marked out of 3.00

What is the probability that the frame contains no errors? Write your answer to 4 decimal places with no rounding.

(penalty regime: 50, 100 %)

Answer: 0.8514 ✔

Question **14**

Correct

Marked out of 2.00

If the single bit error rate was increased from 10^{-2} to 10^{-1} how would the probability of the received frame having no bit errors change?

(penalty regime: 100 %)

Select one:

- a. The probability that the frame arrives with no bit errors decreases ✔
- b. The probability that the frame arrives with no bit errors increases

Your answer is correct.

Question **15**

Correct

Marked out of 2.00

Now add a parity bit to each character. How does the probability that the received frame arrives with no bit errors change?

(penalty regime: 100 %)

Select one:

- a. The probability that the frame arrives with no bit errors increases
- b. The probability that the frame arrives with no bit errors decreases ✔

Your answer is correct.

Information

Alice sends the data block (99F3 FF27 E34F) to Bob, which is given in hexadecimal.

Please answer questions 16-18 using the description above.

Question **16**

Not answered

Marked out of 3.00

What is the partial sum on 99F3 and FF27? If there is carry on the leftmost bit, please add it to the sum.

Please give the answer in hexadecimal without leading '0x'.

(penalty regime: 50, 100 %)

Answer: ✖

Question **17**

Not answered

Marked out of 5.00

What is the result after the ones-complement addition on the whole data block send by Alice?

Please give the answer in hexadecimal without leading '0x'.

(penalty regime: 50, 100 %)

Answer: ✖

Question **18**

Not answered

Marked out of 2.00

What is the Internet checksum of the data block sent by Alice (i.e., the ones-complement operation on the result obtained in the previous question)?

Please give the answer in hexadecimal without leading '0x'.

(penalty regime: 50, 100 %)

Answer: ✖

Information

In CRC suppose we are given a pattern, G=101101, and a message, D=1101101.

Please answer questions 19 and 20 using the description above.

Question **19**

Not answered

Marked out of 2.00

Referring to the message (D) and pattern (G) given in the description above, what would be the size in bits of the Frame Check Sequence (FCS)?

Please specify the number.

(penalty regime: 50, 100 %)

Answer:

Question **20**

Not answered

Marked out of 8.00

What is the corresponding Frame Check Sequence (FCS) given the message (D) and pattern (G) given in the description above?

Please specify the FCS in binary without leading '0b'.

(penalty regime: 50, 100 %)

Answer:

Information

Two neighbor nodes A and B use a sliding-window protocol with a 3-bit sequence number. As the ARQ mechanism, go-back-N is used with a window size of 4. Assume that A is transmitting and B is receiving. Please answer the following questions and only specify numbers.

In the following, when referring to the 'current window size' we mean the number of frames within the current window that can still be sent as new frames, e.g. when the current window covers sequence numbers 0, 1, 2, and 3, and you have already sent frames with sequence numbers 0 and 1, you can still send two further new frames (with sequence numbers 2 and 3) before you have to block, and hence your current window size at that point is 2.

Question **21**

Not answered

Marked out of 10.00

Referring to the description above answer the following question.

(penalty regime: 50, 100 %)

After A sends frames 0, 1, 2, 3 and receives acknowledgements from B for 0, 1, 2 , the current window size of A becomes

and the sequence number of the first frame in the sliding window of A is

After B receives frames 0, 1, 2 and acknowledges 0, 1, and 2, the current window size of B becomes

and the sequence number of the first frame in the sliding window of B is

After A sends frames 4, 5 and receives acknowledgement from B for 3, the current window size of A becomes

and the sequence number of the first frame in the sliding window of A is

After B receives frames 3, 4, and 5 and acknowledges 3, the current window size of B becomes

and the sequence number of the first frame in the sliding window of B is

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