Started on	Wednesday, 2 October 2019, 6:20 PM
State	Finished
Completed on	Sunday, 6 October 2019, 6:37 PM
Time taken	4 days
Marks	85.00/98.00
Grade	**86.73** out of 100.00

Information

Consider a frame consisting of two characters of eight bits each. Assume that the probability of bit error is 10^{-3} and that it is independent for each bit.

With this information, answer the following questions.

Question **1**

Correct

Mark 2.00 out of 2.00

What is the probability that the received frame contains zero bit errors? Write your answer to 3 places after the decimal point with no rounding.

Penalty Regime: 33%, 66%, 100%

Answer: 0.984 ✔

The correct answer is: 0.984

Correct

Marks for this submission: 2.00/2.00.

Question **2**

Correct

Mark 4.00 out of 4.00

What is the probability that the received frame contains at least one bit error? Write your answer to 3 places after the decimal point with no rounding.

Penalty Regime: 33%, 66%, 100%

Answer: 0.015 ✔

The correct answer is: 0.015

Correct

Marks for this submission: 4.00/4.00.

Information

Consider a frame consisting of two characters of eight bits each. Assume that the probability of bit error is 10^{-3} and that it is independent for each bit. Now add a parity bit to each character.

With this information, answer the following questions.

Question **3**

Correct

Mark 2.00 out of 2.00

What is the probability that the received frame contains zero bit errors? Write your answer to 3 places after the decimal point with no rounding.

Penalty Regime: 33%, 66%, 100%

Answer: 0.982 ✔

The correct answer is: 0.982

Correct

Marks for this submission: 2.00/2.00.

Question **4**

Correct

Mark 2.00 out of 2.00

What is the probability that the received frame contains at least one bit error (in the data or the parity bits)? Write your answer to 4 places after the decimal point with no rounding.

Penalty Regime: 33%, 66%, 100%

Answer: 0.0178 ✔

The correct answer is: 0.0178

Correct

Marks for this submission: 2.00/2.00.

Information

Alice sends the data block (E34F 2396 4427 99F3) to Bob.

With this information, answer the following questions.

Question **5**

Partially correct

Mark 2.00 out of 3.00

What is the partial sum on E34F and 2396? If there is carry on the leftmost bit, please add it to the sum.

Please give the answer in hexadecimal.

Penalty Regime: 33%, 66%, 100%

Answer: 0x06E6 ✔

The correct answer is: 06E6

Partially correct

Marks for this submission: 3.00/3.00. Accounting for previous tries, this gives **1.00/3.00**.

Comment:

Question **6**

Correct

Mark 5.00 out of 5.00

Alice sends the data block (E34F 2396 4427 99F3) to Bob.

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

Please give the answer in hexadecimal.

Penalty Regime: 33%, 66%, 100%

Answer: 0xE500 ✔

The correct answer is: E500

Correct

Marks for this submission: 5.00/5.00.

Question **7**

Correct

Mark 2.67 out of 4.00

Compute the Internet checksum for the data block. Give the result as a hexadecimal number.

Penalty Regime: 33%, 66%, 100%

Answer: 0x1AFF ✔

The correct answer is: 1AFF

Correct

Marks for this submission: 4.00/4.00. Accounting for previous tries, this gives **2.67/4.00**.

Information

In CRC suppose we are given a divisor pattern, G=110011 and a data block D=11100011, apply CRC to detect errors. Please answer the following questions.

Question **8**

Correct

Mark 4.00 out of 4.00

What would be the size in bits of the Frame Check Sequence (FCS)?

Penalty Regime: 33%, 66%, 100%

Answer: 5 ✔

The correct answer is: 5

Correct

Marks for this submission: 4.00/4.00.

Question **9**

Correct

Mark 12.00 out of 12.00

What is the corresponding Frame Check Sequence (FCS)? Please enter the FCS in the binary format.

Penalty regime 33%, 66%, 100%

Answer: 11010 ✔

The correct answer is: 11010

Correct

Marks for this submission: 12.00/12.00.

Question **10**

Correct

Mark 3.00 out of 3.00

Match the following descriptions with the corresponding ARQ types.

Penalty regime: 33%, 66%, 100%

With a window size greater than 1, when an error is detected, only the frame in question is retransmitted. ✔	Selective-reject ARQ
For all packets, the sending station waits for an acknowledgement for the last packet before sending the next packet ✔	Stop-and-wait ARQ
When an error is detected, the frame in question is retransmitted, as well as all subsequent frames that have been previously transmitted, after the last acknowledgement. ✔	Go-back-N ARQ

Your answer is correct.

The correct answer is: With a window size greater than 1, when an error is detected, only the frame in question is retransmitted. → Selective-reject ARQ, For all packets, the sending station waits for an acknowledgement for the last packet before sending the next packet → Stop-and-wait ARQ, When an error is detected, the frame in question is retransmitted, as well as all subsequent frames that have been previously transmitted, after the last acknowledgement. → Go-back-N ARQ

Correct

Marks for this submission: 3.00/3.00.

Question **11**

Correct

Mark 2.67 out of 4.00

Suppose that a selective-reject ARQ is used with a window size of 4, what is the minimum number of bits for a sequence number to stop acknowledgements being misidentified? Think about the case in which the sequence number loops back around.

Penalty regime: 33%, 66%, 100%

Select one:

- a. 1
- b. 2
- c. 3 ✔
- d. 4
- e. 5

Your answer is correct.

The correct answer is: 3

Correct

Marks for this submission: 4.00/4.00. Accounting for previous tries, this gives **2.67/4.00**.

Information

Two neighbor nodes (A and B) use go-back-N with a 3-bit sequence number and a window size of N=4. Assuming A is transmitting and B is receiving, show the window positions (sequence numbers currently in the window) for the following succession of events.

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 **12**

Correct

Mark 2.00 out of 2.00

Before A sends any frames, the current window size of A is 4 ✔ .

Penalty regime: 33%, 66%, 100%

Correct

Marks for this submission: 2.00/2.00.

Question **13**

Correct

Mark 2.00 out of 2.00

Before A sends any frame, the sequence number of the first frame in the sliding window of A is 0 ✔ .

Penalty regime: 33%, 66%, 100%

Correct

Marks for this submission: 2.00/2.00.

Question **14**

Correct

Mark 2.00 out of 2.00

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

Penalty regime: 33%, 66%, 100%

Correct

Marks for this submission: 2.00/2.00.

Question **15**

Correct

Mark 1.33 out of 2.00

After A sends frames 0, 1, 2 and receives acknowledgement from B for 0 and 1, the sequence number of the first frame in the sliding window of A is 3 ✔ .

Penalty regime: 33%, 66%, 100%

Correct

Marks for this submission: 2.00/2.00. Accounting for previous tries, this gives **1.33/2.00**.

Question **16**

Correct

Mark 1.33 out of 2.00

After B receives frames 0, 1, 2 and acknowledges 0, 1, and 2, the current window size of B becomes 4 ✔

Penalty regime: 33%, 66%, 100%

Correct

Marks for this submission: 2.00/2.00. Accounting for previous tries, this gives **1.33/2.00**.

Question **17**

Correct

Mark 2.00 out of 2.00

After B receives frames 0, 1, 2 and acknowledges 0, 1, 2 the sequence number of the first frame in the sliding window of B is 3 ✔

Penalty regime: 33%, 66%, 100%

Correct

Marks for this submission: 2.00/2.00.

Question **18**

Correct

Mark 0.00 out of 2.00

After A sends frames 3, 4, and 5 and B acknowledges 4 and the ACK is received by A, the current window size of A becomes 3 ✔

Penalty regime 33%, 66%, 100%

Correct

Marks for this submission: 2.00/2.00. Accounting for previous tries, this gives **0.00/2.00**.

Question **19**

Correct

Mark 2.00 out of 2.00

After A sends frames 3, 4, and 5 and B acknowledges 4 and the ACK is received by A, the sequence number of the first frame in the sliding window of A is 6 ✔

Penalty regime 33%, 66%, 100%

Correct

Marks for this submission: 2.00/2.00.

Question **20**

Correct

Mark 1.33 out of 2.00

After B receives frames 3 amd 4, the current window size of B becomes 2 ✔

Penalty regime: 33%, 66%, 100%

Correct

Marks for this submission: 2.00/2.00. Accounting for previous tries, this gives **1.33/2.00**.

Question **21**

Correct

Mark 2.00 out of 2.00

After B receives frames 3 and 4, the sequence number of the first frame in the sliding window of B is 5 ✔

Penalty regime: 33%, 66%, 100%

Correct

Marks for this submission: 2.00/2.00.

Question **22**

Correct

Mark 1.00 out of 3.00

Assume A and B are using ARQ go-back-n. After A sends frames 4, 5, 6, 7 and B sends ACK4, what frames are resent after A experiences a timeout? Select all the frames that would be resent.

Penalty regime: 33%, 66%, 100%

Select one or more:

- a. 4
- b. 5 ✔
- c. 6 ✔
- d. 7 ✔

Your answer is correct.

The correct answers are: 5, 6, 7

Correct

Marks for this submission: 3.00/3.00. Accounting for previous tries, this gives **1.00/3.00**.

Question **23**

Correct

Mark 3.00 out of 3.00

Assume A and B are using ARQ selective-reject. After A sends frames 4, 5, 6, 7 and B sends ACK4, ACK6 and ACK7, what frames will A send again after it experiences a timeout? Select all the frames that would be resent.

Penalty regime: 33%, 66%, 100%

Select one or more:

- a. 4
- b. 5 ✔
- c. 6
- d. 7

Your answer is correct.

The correct answer is: 5

Correct

Marks for this submission: 3.00/3.00.

Question **24**

Correct

Mark 2.00 out of 2.00

If stop and wait is treated like a sliding window scheme, what is the maximum window size?

Penalty Regime: 33%, 66%, 100%

Select one:

- a. 0
- b. 1 ✔
- c. 2
- d. 3
- e. 4

Your answer is correct.

The correct answer is: 1

Correct

Marks for this submission: 2.00/2.00.

Information

Two neighbour nodes (A and B) use the ARQ mechanism stop-and-wait for their data transfer. Assuming A is transmitting and B is receiving, show the window sizes and positions for the following succession of events.

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 **25**

Correct

Mark 0.67 out of 2.00

After A sends frame 0, but before A receives an acknowledgement from B for 0, the current window size of A becomes 0 ✔ .

Penalty regime: 33%, 66%, 100%

Correct

Marks for this submission: 2.00/2.00. Accounting for previous tries, this gives **0.67/2.00**.

Question **26**

Correct

Mark 2.00 out of 2.00

After A sends frames 0 and receives acknowledgement from B for 0, the current window size of A becomes 1 ✔ .

Penalty regime: 33%, 66%, 100%

Correct

Marks for this submission: 2.00/2.00.

Question **27**

Correct

Mark 2.00 out of 2.00

Select all the items that can cause transmission errors:

Penalty regime: 33%, 66%, 100%

Select one or more:

- [x] a. Weak signal strength ✔
- [x] b. Jitter (variations in signal timings) ✔
- [x] c. Faulty routers ✔
- [x] d. Crosstalk (signals in one circuit interfering with signals in another circuit) ✔
- [x] e. Thermal noise (noise generated by random thermal motion) ✔
- [x] f. Jamming of a signal ✔
- [x] g. Interference (two waveforms colliding) ✔

Your answer is correct.

The correct answers are: Thermal noise (noise generated by random thermal motion), Interference (two waveforms colliding), Weak signal strength, Faulty routers, Jamming of a signal, Crosstalk (signals in one circuit interfering with signals in another circuit), Jitter (variations in signal timings)

Correct

Marks for this submission: 2.00/2.00.

Question **28**

Correct

Mark 2.00 out of 2.00

Is the Automatic Repeat Request (ARQ) protocol closed loop or open loop error control?

Penalty regime: 100%

Select one:

- a. ARQ is open loop error control as ARQ does not send feedback
- b. ARQ is closed loop error control as ARQ sends feedback ✔

Your answer is correct.

The correct answer is: ARQ is closed loop error control as ARQ sends feedback

Correct

Marks for this submission: 2.00/2.00.

Question **29**

Correct

Mark 2.00 out of 2.00

The Internet checksum in the IP header is needed even when the link layer performs perfect error checking, because:

Select one:

- a. every layer in the Open Systems Interconnection (OSI) model needs an error-detecting technique.
- b. this allows the packet to do Forward Error Correction (FEC) if there is a one bit error.
- c. the Cyclic Redundancy Check (CRC) check is weaker than the Internet Checksum and therefore could miss out on more errors.
- d. even if it travels through the transmission medium perfectly, router memory could cause an error in the packet. ✔

Your answer is correct.

The correct answer is: even if it travels through the transmission medium perfectly, router memory could cause an error in the packet.

Correct

Marks for this submission: 2.00/2.00.

Question **30**

Correct

Mark 2.00 out of 2.00

Using even parity, what is the parity bit if the frame is 01010111?

Write just the additional parity bit, rather than the full codeword

Penalty regime: 100%

Answer: 1 ✔

The correct answer is: 1

Correct

Marks for this submission: 2.00/2.00.

Question **31**

Correct

Mark 2.00 out of 2.00

Using odd parity, what is the parity bit if the frame is 01010111?

Write just the additional parity bit, rather than the full codeword

Penalty regime: 100%

Answer: 0 ✔

The correct answer is: 0

Correct

Marks for this submission: 2.00/2.00.

Information

Suppose there are senders A and B that want to send data between each other although there is interference on the channel connecting them. To overcome this issue both A and B agree on a Hamming code to use so that errors can be detected or corrected (depending on the severity of the error). The messages and the codewords they map to are given below.

Message	Codeword
0000	0000000
0001	0001111
0010	0010011
0011	0011100
0100	0100101
0101	0101010
0110	0110110
0111	0111001
1100	1100011
1101	1101100
1110	1110000
1111	1111111
1000	1000110
1001	1001001
1010	1010101
1011	1011010

With this information, answer the following questions.

Question **32**

Correct

Mark 2.00 out of 2.00

Suppose that user A sends user B the codeword 0110110. Assuming there were no errors, what is the message that user B has received?

Penalty Regime: 33%, 66%, 100%

Answer: 0110 ✔

The correct answer is: 0110

Correct

Marks for this submission: 2.00/2.00.

Question **33**

Correct

Mark 2.00 out of 2.00

Suppose now that user B receives a codeword 1001011 from user A. What is the Hamming distance from 1011010?

Penalty Regime: 33%, 66%, 100%

Answer: 2 ✔

The correct answer is: 2

Correct

Marks for this submission: 2.00/2.00.

Question **34**

Correct

Mark 2.00 out of 2.00

With the same codeword as before (1001011), what is the Hamming distance from the received codeword and 1001001?

Penalty Regime: 33%, 66%, 100%

Answer: 1 ✔

The correct answer is: 1

Correct

Marks for this submission: 2.00/2.00.

Question **35**

Correct

Mark 3.00 out of 3.00

With reference to the last two questions, suppose user B receives 1001011 from user A. Which conclusion can B draw?

Penalty Regime: 50%, 100%

Select one:

- a. There is one bit error in the received block which we are able to correct.
- b. We have detected two bit errors in the received block.
- c. It could either be two (detectable) bit errors or one (correctable) bit error. Without further configuration B cannot decide on the proper action. ✔ Correct. Both is possible (although in general these two events do not have the same probability), user A could either have sent 1011010 or 1001001, and B cannot reliably distinguish between these possibilities. It can only suspect that the option with fewer bit errors is the more likely one.

Your answer is correct.

The correct answer is: It could either be two (detectable) bit errors or one (correctable) bit error. Without further configuration B cannot decide on the proper action.

Correct

Marks for this submission: 3.00/3.00.

Question **36**

Correct

Mark 0.00 out of 2.00

There is another class of Hamming codes that are extended with an additional parity bit, providing the ability to detect up to three errors, correct up to two errors, or simultaneously correct up to one error and detect up to two errors. How would the code rate of the extended Hamming code compare to normal Hamming codes? The code rate is defined as the ratio of the number k of user data bits to the total number n of bits for the coded message (which includes the user data and redundant bits), i.e. k/n.

Penalty Regime: 100%

Select one:

- a. The code rate of the extended hamming code would be smaller. ✔
- b. The code rate of the extended hamming code would be larger.

Your answer is correct.

The correct answer is: The code rate of the extended hamming code would be smaller.

Correct

Marks for this submission: 2.00/2.00. Accounting for previous tries, this gives **0.00/2.00**.

◄ Quiz: Routing (Practice copy) Jump to... Quiz: Error Detection, Correction, and Control Problems (Practice copy) ►