COMP 3005: Database Management Systems (Exam Date: December 9th 2019 (9:00 AM))

Exam Review

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Important Note: The University Schema and the ER Diagram associated are at the end of the document.

Q 1: (1 points)

The lowest frequency of a signal 2, 200 Hz and the highest 7, 800 Hz. What is the bandwidth?

1. 2, 800 Hz
2. 8, 000 Hz
3. 5, 600 Hz
4. 4, 000 Hz

(Solution) 5, 600 Hz

Q 2: (1 points)

What is the period of a signal with frequency 0.05?

1. 20
2. 10
3. 40
4. .95

(Solution) 20

Q 3: (1 points)

Which of the following physical layer transmission methods doubles the number of bits?

1. NRZ-L
2. Manchester
3. NRZ-I
4. 4B/5B

(Solution) Manchester

Q 4: (1 points)

A sinusoid wave is given as a function $w(t)$ of time t by the formula: $w(t) = 6\sin(\frac{\pi}{4} + 40\pi t)$. What is the frequency, phase, and amplitude in this order?

1. frequency 40, phase $\pi/8$, and amplitude 6
2. frequency 20, phase $\pi/8$, and amplitude 6

3. frequency 20, phase $\pi/4$, and amplitude 3
4. frequency 40, phase $\pi/4$, and amplitude 6

(Solution) frequency 20, phase $\pi/8$, and amplitude 6

Q 5: (1 points)

Why is frequent bit alternation important in the physical layer bit streams?

1. To improve quality of signal
2. To avoid signal collisions
3. To prevent baseline wander
4. To prevent bit collisions

(Solution) To prevent baseline wander

Q 6: (1 points)

An adversary is cutting wires (links) to disconnect the nodes of the network depicted above. What is the minimum number of links to be cut so as to partition the network into two connected subnets of size 4 nodes each?

1. 4
2. 2
3. 1
4. 5

(Solution) 5

Q 7: (1 points)

What is the redundency of the 2 dimensional parity check algorithm on $m \times n$ bit words as a function of m and n?

1. $\frac{1}{m} + \frac{1}{n}$
2. $\frac{1}{mn}$
3. $1 + \frac{m}{n}$
4. $1 + \frac{1}{m} + \frac{1}{n}$

(Solution) $1 + \frac{1}{m} + \frac{1}{n}$

Q 8: (1 points)

The bandwidth of a channel is 200 $Mbps$. What is the transmission delay (in seconds) for a 10 Kb packet?

1. $\frac{1}{2} \cdot 10^5 s$
2. $2 \cdot 10^3 s$
3. $10^{-3} s$
4. $\frac{1}{2} \cdot 10^{-4} s$

(Solution) $\frac{1}{2} \cdot 10^{-4} s$

Q 9: (1 points)

How many bits can a transcontinental channel hold if it has one-way latency of 100 ms and a bandwidth of 40 $Mbps$? Express your answer in Mb.

1. 2 Mb
2. 40 Mb
3. 4 Mb
4. 10 Mb

(Solution) 4 Mb

Q 10: (1 points)

What is the propagation delay on a 6 km long coaxial cable having speed 3×10^8 m/s?

1. $2 \cdot 10^{-5} s$
2. $18 \cdot 10^{-11} s$
3. $\frac{1}{2} \cdot 10^{-5} s$
4. $18 \cdot 10^{-5} s$

(Solution) $2 \cdot 10^{-5} s$

Q 11: (1 points)

What's the max number of errors that the $n \times n$ LRC (Longitudinal Redundancy Check) code can detect?

1. One
2. Two
3. $2n$
4. $\frac{2}{n}$

(Solution) Two

Q 12: (1 points)

What's the max number of errors that the LRC (Longitudinal Redundancy Check) code can correct?

1. n
2. $\frac{1}{n}$
3. Two
4. One

(Solution) One

Q 13: (1 points)

Give the Hamming distance between the bit strings

1. 7
2. 10
3. 6
4. 8

(Solution) 6

Q 14: (1 points)

In the CRC code a polynomial is converted to a bit sequence. To what bit sequence is the polynomial $x^7 + x^5 + x^2 + x + 1$ converted to?

1. 10100101
2. 11100011
3. 10100111
4. 10100010

(Solution) 10100111

Q 15: (1 points)

The result of multiplying in mod2 arithmetic the two polynomials $P(x) = 2x + 5$ and $Q(x) = 4x^3 + 3x - 2$ is equal to

1. $12x^4$
2. $x^2 + 1$
3. $9x^2$
4. xx^2

(Solution) $x^2 + 1$

Q 16: (1 points)

In selective reject ARQ protocol SREJ

1. the receiver may reject a packet sent by the sender.
2. both sender and receiver may reject a packet.
3. the sender may reject a packet acknowledged by the receiver.
4. the receiver rejects packets sent twice by the sender.

(Solution) the receiver may reject a packet sent by the sender.

Q ((1 points)

7:)1 In the Stop-and-Wait protocol

1. the receiver must stop and wait after receiving a packet.
2. the sender must stop and wait after sending a packet.

3. the recevier must stop and wait after receiving a packet in error.
4. the sender must stop and wait after sending a packet in error.

(Solution) the sender must stop and wait after sending a packet.

Q 18: (1 points)

Four packets enter from each of inputs in_0, in_1, in_2, in_3 at the same time and exit from ouputs $out_0, out_1, out_2, out_3$ following shortest paths. The transmission delay at all the nodes is 1 time unit regardless of the number of packets being processed and there is no processing delay. Propagation delay of all horizontal links is 1 time unit, and of all vertical links 2 time units. Source nodes do not incur transmission and propagation delays. How long (in time units) does it take a packet entering in_1 to exit at out_2?

1. 12
2. 14
3. 13
4. 15

(Solution) 14

Q 19: (1 points)

A transmission line has bandwidth 1, 200 Hz and signal to noise ratio 15. The (Shannon) capacity of the channel is

1. 2, 400
2. 3, 600
3. 9, 600
4. 4, 800

(Solution) 4, 800

Q 20: (1 points)

Initially the four nodes a, b, c, d of the square below have 0,4,0,2 packets, respectively. A flooding algorithm at a node v can deliver one packet per neighbour only if its current value n_v is at least $\deg(v)$. Flooding is done synchronously by all the nodes. What is the result of applying flooding to the graph below after two iterations? Note the links are duplex.

1. $(n_a, n_b, n_c, n_d) = (0, 3, 0, 3)$
2. $(n_a, n_b, n_c, n_d) = (2, 0, 2, 2)$
3. $(n_a, n_b, n_c, n_d) = (3, 0, 3, 0)$
4. $(n_a, n_b, n_c, n_d) = (2, 2, 2, 0)$

(Solution) $(n_a, n_b, n_c, n_d) = (2, 0, 2, 2)$

Q 21: (1 points)

A wireless network has packet size 5, 000 b and bit error rate 10^{-4}. How many bit errors do you expect in a packet?

1. 2
2. 1/2
3. 50
4. 10

(Solution) 1/2

Q 22: (1 points)

A wireless network has packet size 5, 000 b and bit error rate 10^{-4}. Would you recommend a network designer to use this packet length?

1. YES, because this is always done in wireless.
2. YES, because the bit error rate is not high.
3. NO, because every tenth packet is expected to have an error.
4. NO, because every second packet is expected to have an error.

(Solution) NO, because every second packet is expected to have an error.

Q 23: (1 points)

Consider a network of k servers $S_1 \to S_2 \to ... \to S_k$ in tandem. When server S_i sends a packet of length l bits to the next server S_{i+1} it adds a header of length h bits. A packet of l bits enters the network from S_1 and exits from S_k. What is teh smallest number k (expressed as a function of l, h) of servers se that the resulting packet has length $\geq 2l$. (Assume all servers send a packet.)

1. $k \geq \lfloor 2l/h \rfloor + 2$
2. $k \geq lh$
3. $k \geq \lceil l/h \rceil$
4. $k \geq \lceil l/2h \rceil$

(Solution) $k \geq \lceil l/h \rceil$

Q 24: (1 points)

A network uses packets of length n an it is operating over a medium with bit error rate p. You are given two fixed bit positions in the packet. What is the probability that these two have errors and the remaining position have none? (Assume teh bit-errors in the packet are independent.)

1. $p^2(1-p)^{n-2}$
2. $\binom{n}{2}p^2(1-p)^{n-2}$
3. p^2
4. $\binom{n}{2}(1-p)^{n-2}$

(Solution) $\binom{n}{2}p^2(1-p)^{n-2}$

Q 25: (1 points)

A source generates messages consisting of n bits. What fraction of the messages have exactly k 1s.

1. $\binom{n}{k}2^{n-k}$
2. 2^{-k}
3. 2^{n-k}
4. $\binom{n}{k}2^{-n}$

(Solution) $\binom{n}{k}2^{-n}$

Q 26: (1 points)

Consider a line graph of five nodes. What is the average hop-distance between pairs of nodes?

1. 2
2. 2.5
3. 3
4. 4

(Solution) 2