ITS 323 – QUIZ 3 (ITB) ANSWERS

First name: _____   Last name: _____
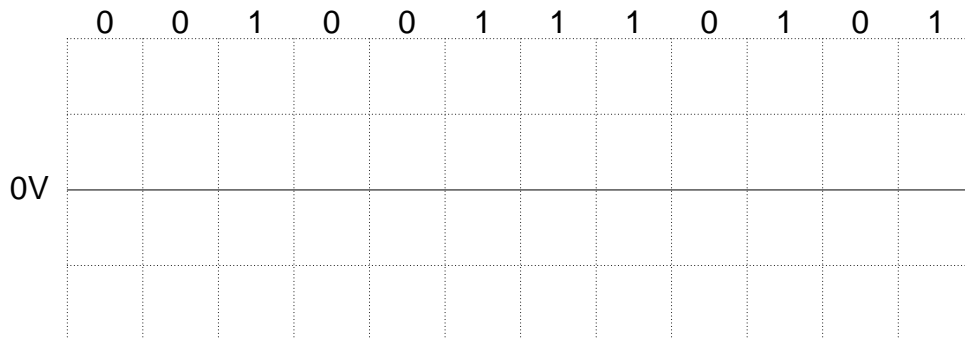
ID: _____   Total Marks: _____
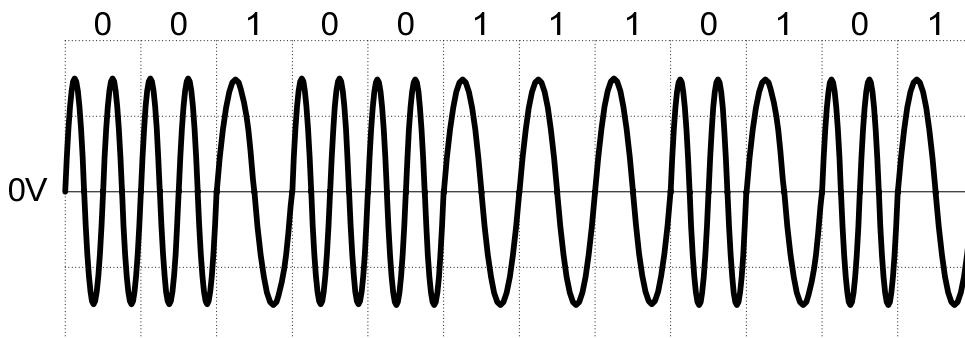
out of 10

Question 1 [2 marks]

Draw the analog signal used to transmit the digital data below if Frequency Shift Keying is used.

0   0   1   0   0   1   1   1   0   1   0   1

0V ————————————————————————

Answer

Note that high frequency is used for 0 and low frequency for 1 in the answer below. The opposite is also correct.

Question 2 [2 marks]

A single bit odd parity check is applied to an 8-bit data frame. For the following cases of errors, indicate if the receiver can detect the error or not (circle the answer):

a)	The parity bit is in error	DETECT	NOT DETECT
b)	The first bit of the data frame is in error	DETECT	NOT DETECT
c)	The first two bits of the data frame are in error	DETECT	NOT DETECT
d)	The first three bits of the data frame are in error	DETECT	NOT DETECT

Answer

a. DETECT   b. DETECT   c. NOT DETECT   d. DETECT

A single bit parity check can detect an odd number of errors (1 error or 3 errors or 5 errors). It doesn't matter if it is the parity bit that is in error. The treats all 9 bits equally.

Question 3 [3 marks]

An error correcting code maps 2-bits of data into a 4 bit codeword according to the following scheme:

- 00   =>   1001
- 01   =>   0111
- 10   =>   1011
- 11   =>   1100

The Hamming distance is used to correct errors.

For the following received codewords, indicate what the receiver does. That is, either:

- Assumes NO ERROR;
- Successfully DETECTs and CORRECTs error;
- DETECT ONLY, but cannot correct;

If NO ERROR or DETECT/CORRECT, indicate the received data.

a) 0000   NO ERROR   DETECT/CORRECT   DETECT ONLY

Received Data: _____

b) 0101   NO ERROR   DETECT/CORRECT   DETECT ONLY

Received Data: _____

c) 1001   NO ERROR   DETECT/CORRECT   DETECT ONLY

Received Data: _____

Answer

0000 – DETECT ONLY

Why? Not a valid codeword (hence DETECT); two valid codewords have minimum Hamming distance of 2 (1001 and 1100) and hence connect determine correct codeword

0101 – DETECT/CORRECT, Received Data: 01

Why? Not a valid codeword (hence DETECT); unique minimum Hamming is 1 (0111) hence CORRECT

1001 – NO ERROR, Received Data: 00

Why? Valid codeword

Question 4 [3 marks]

What is the maximum throughput of the Stop and Wait Flow Control protocol.

You can assume:

- Data rate is 1Mb/s
- Data frame size is 10,000 bits

- ACK size is 100 bits

- Propagation time is 10msec

- No processing delay

Answer

The efficiency is time spent sending DATA frames divided by total time spent in transfer. The total time is: time spent sending DATA frames + DATApropagation + ACKpropagation + ACKtransmision

$$Eff = \frac{DataTransmission}{DataTransmission + 2 \times \Pr opagation + ACKTransmission}$$

$$= \frac{\left(10,000 \middle/ 1,000,000\right)}{\left(10,000 \middle/ 1,000,000\right) + 2 \times 10ms + 100 \middle/ 1,000,000}$$

$$= \frac{10}{10 + 20 + 0.1} ms$$

$$= 0.33$$

Therefore throughput is 0.33 x 1Mb/s = 0.33Mb/s