MODEL SOLUTIONS

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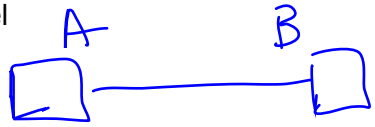
CS224M Quiz-1

Max Marks: 35

Q1. (6 marks) Explain briefly the meaning of the following:

a) Simplex communication channel

Ans:



Communication is only possible in 1 direction

Eg: from A to B, but not B to A

b) Full duplex communication channel

Ans:

Communication is possible from A to B AND B to A simultaneously

c) Half duplex communication channel

Ans:

Communication is possible from A to B and B to A, but NOT simultaneously

Q2. (9 marks) State and discuss 3 disadvantages of Protocol Layering mentioned in class

Ans:

1) Suboptimality: Routes chosen may not be shortest

Eg: Whatsapp call between 2 people in same room may go over many hops in the Internet as Appl. layer does not know that

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the 2 persons are physically close

2) Redundancy: Same functionality may be replicated across different layers.

Eg: packet retransmissions on packet loss

3) Higher layers may make incorrect assumptions or inferences about what happens at lower layers

Ex: TCP may infer that loss occurred due to queue overflow but it could have been caused by some other reason such as wireless interference

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Q3. (2 marks) What are the quality-of-service requirements for Voice-over-IP (such as a Whatsapp voice call) in terms of round-trip-time (give answer in ms) and throughput (give answer in kbps)? It is good enough if you give rough ball-park numbers. You need not give any deeper explanation for this answer, just give the QoS requirements.

Ans:

Throughput : 64 kbps is sufficient
(Ans in few tens of kbps is acceptable)

RTT : few hundreds of ms
(a second and higher is too much)

Q4. (4 marks) An undersea optic fiber has attenuation 0.6 dB per kilometer. Suppose the length of this undersea fiber is 100 km. A signal of power 10 W is input at one end of the fiber. What is the power of the signal at the output of the fiber? Show your working.

Ans:

Total attenuation $= 100 \times 0.6 = 60$ dB

$P_{in} = 10$ W

$$10 \log_{10} \frac{P_{in}}{P_{out}} = 60$$

$$\Rightarrow \frac{P_{in}}{P_{out}} = 10^6$$

$$\Rightarrow P_{out} = \frac{10}{10^6} = 10^{-5} \text{ W}$$ Ans

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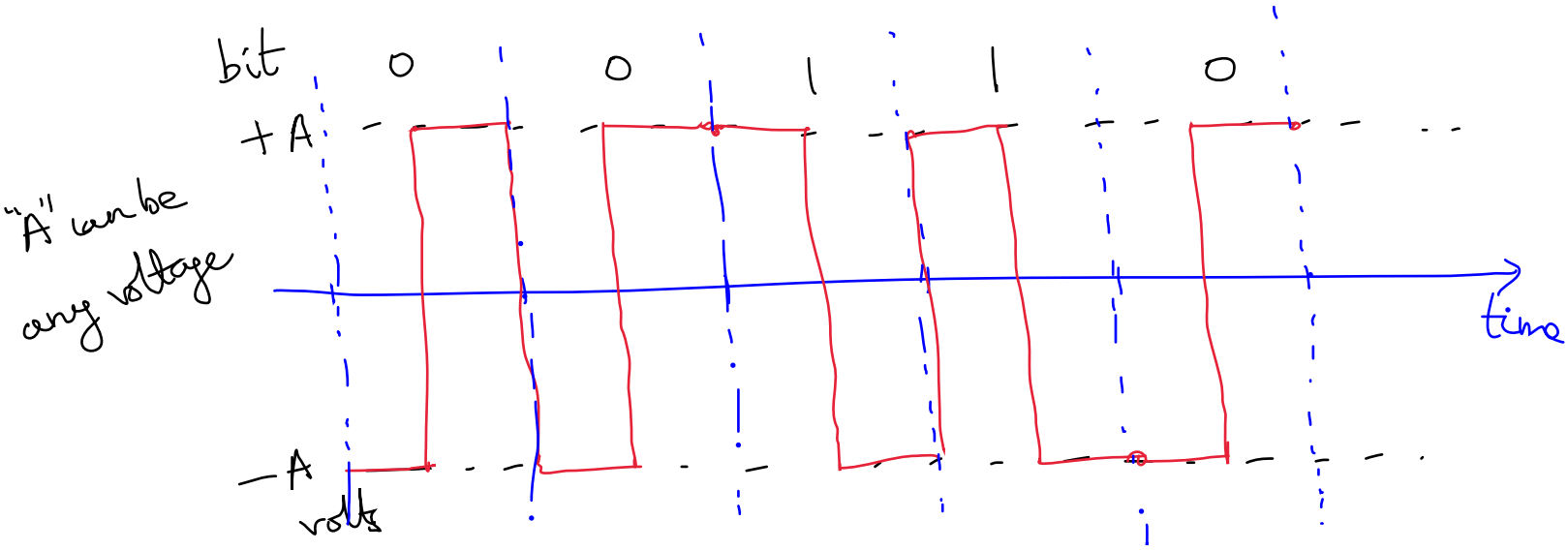
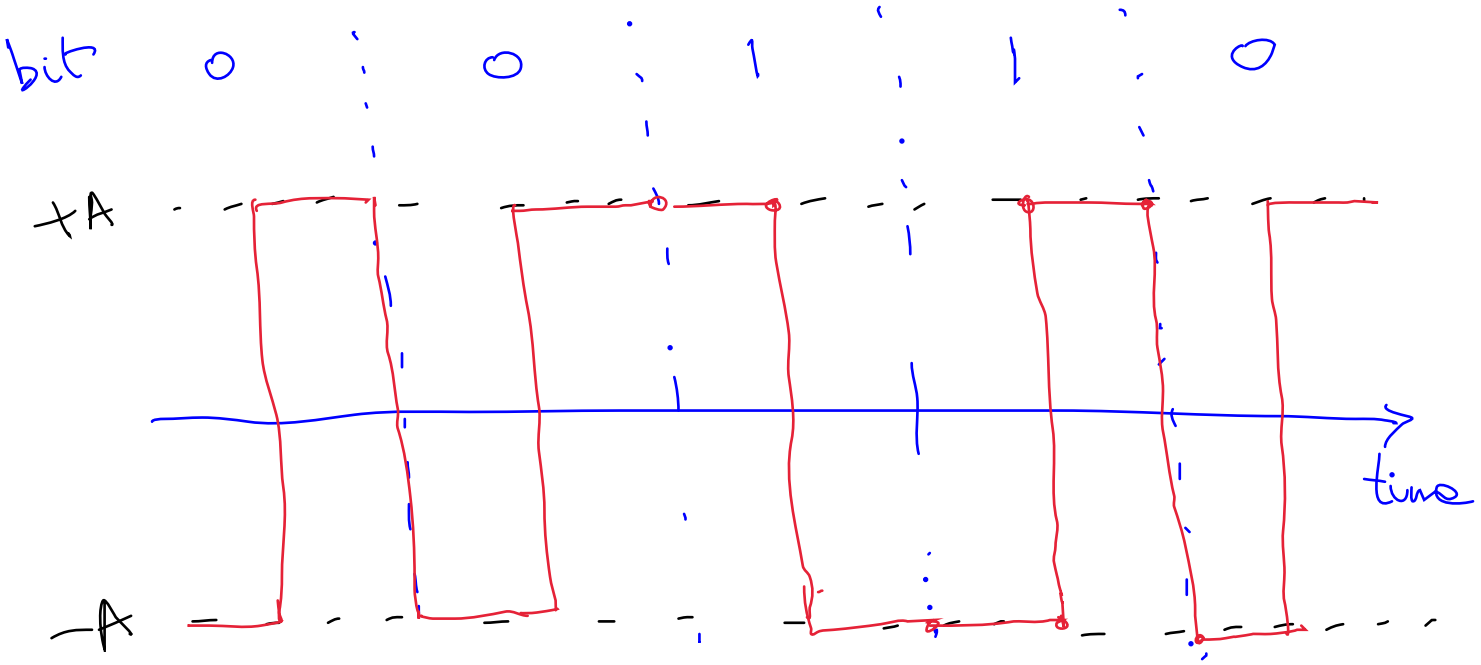
Q5. (6 marks) A transmitter wants to send 5 bits: 0, 0, 1, 1, 0 over a twisted pair cable.

a) Suppose that the transmitter uses Manchester coding. Draw the shape of the signal on the timeline. Indicate clearly which part of the signal represents which bit.



b) Suppose that the transmitter uses Differential Manchester coding. Draw the shape of the signal on the timeline. Assume that the shape of the signal representing the first bit is exactly the same as in part (a) above.



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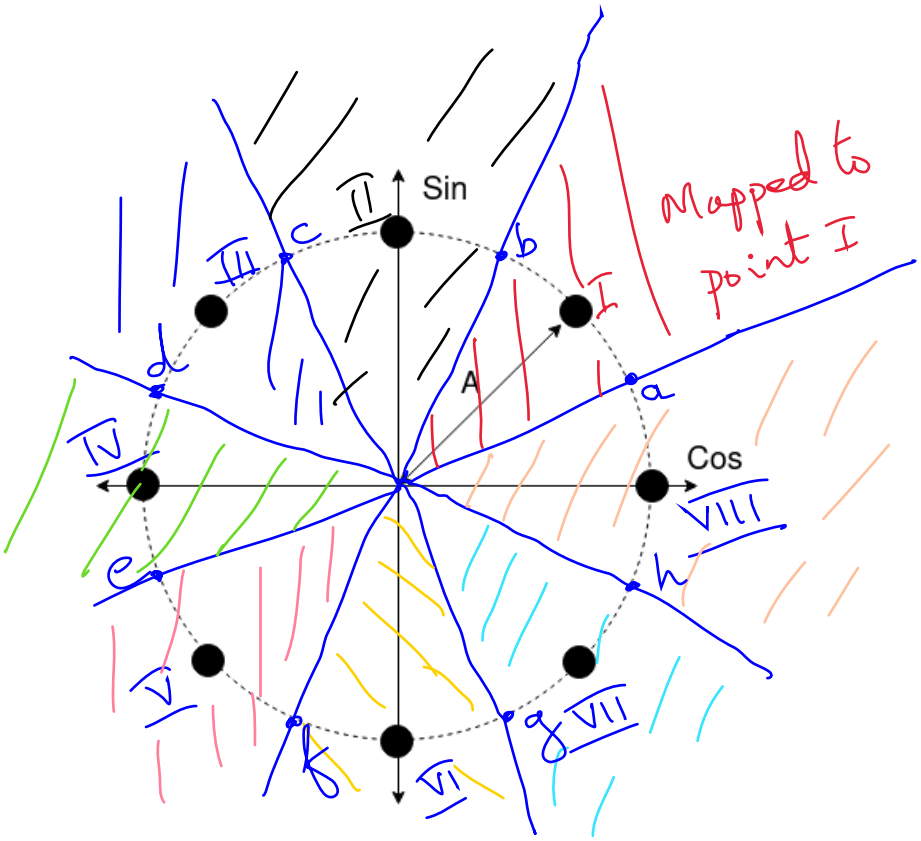
Q6. (8 marks) The following figure shows the 8-PSK constellation diagram (with In-phase (Cos) and Quadrature phase (Sin) on the X and Y axes respectively). This constellation has 8 different constellation points, all of which are uniformly spaced on a circle (with radius "A") centred at the origin. Ignore signal attenuation and assume that any transmitted constellation point is corrupted by additive white Gaussian noise at the receiver. Assume that all constellation points are equally likely to be transmitted. In the same diagram, clearly indicate the regions in the constellation diagram which are to be mapped to each of the 8 constellation points at the receiver. You need not give any explanation. Just draw the regions asked for.



Points a, b, c, d, e, f, g, h are uniformly distributed on the circle, and are obtained by rotating the constellation diagram by 22.5° about the origin.

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EXTRA PAGE