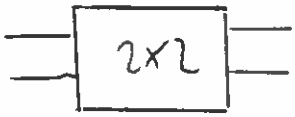
NAME:_____

Midterm ESE/CSE 346 T. Robertazzi Fall 2019

Answer all questions. Total is 20 points: Q1:8 pts, Q2: 6 Pts, Q3: 6 pts. Show any work.

1. Consider a 2 input, 2 output switching element. Inputs are Bernoulli. That is let p be the independent probability of a packet in a slot at an input and 1-p be the independent probability of no packet in a slot at an input.



(a) Find an expression for the probability of at least one packet arriving to the inputs in a time slot. Call it "q".

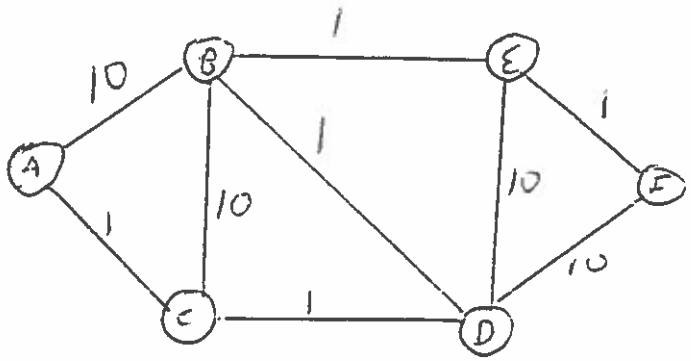
(b) Find an expression for the probability of at least one packet arriving to the inputs for the first time in the ith slot. Phase the answer in terms of q.

(c) Say a switching element has ten Bernoulli inputs. Find an expression for the average number of arriving packets across all inputs in a slot. There are two possible answers.

(d) Say a switching element has N Bernoulli inputs. On a single input what is the average number of arriving packets in 10 consecutive slots? There are two possible answers.

2. Suppose a received codeword using a Hamming code is 0110101. Which if any bit has an error? Show work perhaps with a diagram.

3. Let node A be the root. Find the algorithm table of the Dijkstra algorithm. Use only distance in the entries. Label the columns B thru F from left to right.



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Answers

1.

(a) P(at least one arrival packet in a slot)

$= 1 - (1-p)^2$

$= \binom{2}{1} p(1-p) + p^2 = p$

(b) Prob (1st or first two arrival packet in ith slot)

$= (1-p)^{i-1} p$

2.

(a) SE has 10 inputs. Each input has an arrival Bernoulli packet each slot with prob p. What is pdf # arriving packets in a slot

10p. or $\sum_{i=1}^{10} i \binom{10}{i} p^i (1-p)^{10-i}$

(b)

(c) SE has N inputs. On a single input what is the average number of packets in 10 consecutive slots.

$10p = \sum_{i=1}^{10} i \binom{10}{i} p^i (1-p)^{10-i}$

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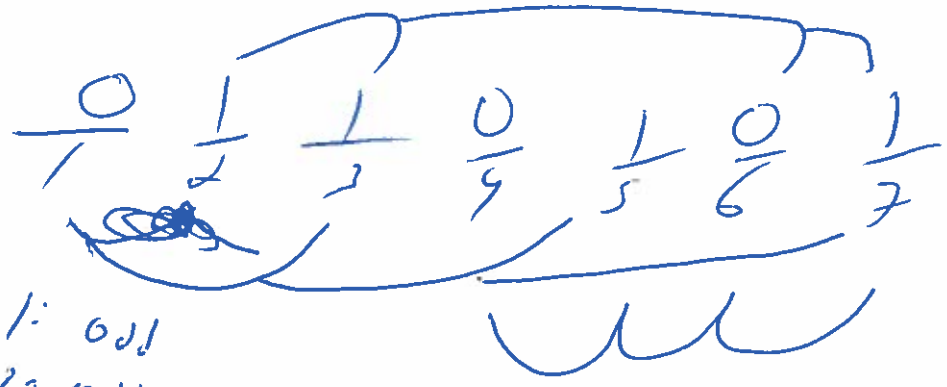
2.

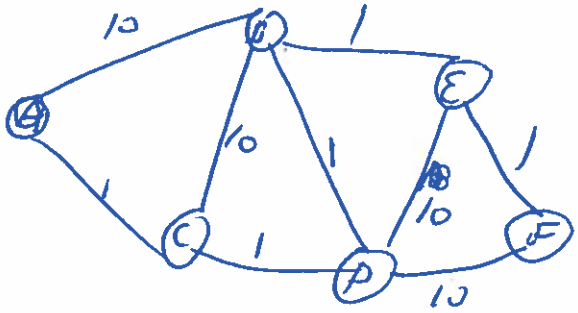


1: 001

2: 001

4: 100 + 11 = 3 3rd bit should be 0

3.



	N	B	C	D	E	F
1	{A}	10	1	∞	∞	∞
2	{A,C}	10	(1)	2	∞	∞
3	{A,C,D}	3	1	(2)	12	12
4	{A,C,D,B}	(3)	1	2	4	12
5	{A-E}	3	1	2	(4)	5
6	{A-F}	3	1	2	4	(5)