King Fahd University of Petroleum & Minerals
Electrical Engineering Department
EE315: Probabilistic Methods in Electrical Engineering (112)

Major Exam I

March 10, 2012
7:00-8:30 PM
Building 59-Rooms 2001-2004

Name: _____ _____

ID#_____

Question	Mark
1	/10
2	/10
3	/10
4	/10
Total	/40

Instructions:

1. This is a closed-books/notes exam.
2. The duration of this exam is one and half hours.
3. Read the questions carefully. Plan which question to start with.
4. CLEARLY LABEL ALL SIGNIFICANT VALUES ON BOTH AXIES OF ANY SKETCH
5. Work in your own.
6. Strictly no mobile phones are allowed.
7. Table Attached

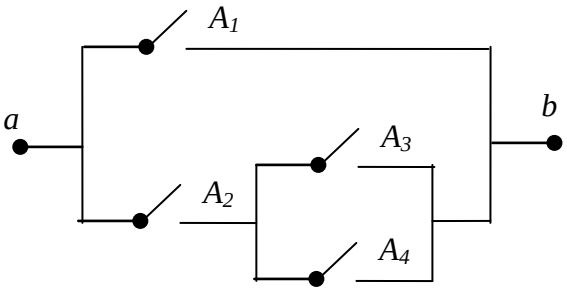
Good luck

Mark	sec	Timing	Instructor
	1	SMW 9:00	Dr. Ahmed Masoud
	2	UT 10:00	Dr. Ali Muqaibel (Coordinator)
	3	UT 08:30	Dr. Saad Al-Ubaidi
	4	UT 10:00	Dr. Saad Al-Ubaidi

Problem 1: (10 points)

Consider the following switching network shown. Let A_1, A_2, A_3, and A_4 denote the events that the associated switches are closed (connecting). Let A_{ab} denote the event that there is a closed path between terminals a and b. (i.e $A_{ab}closed$)

a) Express A_{ab} in terms of A_1, A_2, A_3, and A_4 **(2 points)**



b) If all switches are independent and the probability of being closed is 0.5. That is $P(A_1) = P(A_2) = P(A_3) = P(A_4) = 0.5$. Find $P(A_{ab})$. *i.e P(path between a and b is closed (connecting))* **(3 points)**

Complete the missing term(s) **(3 points)**

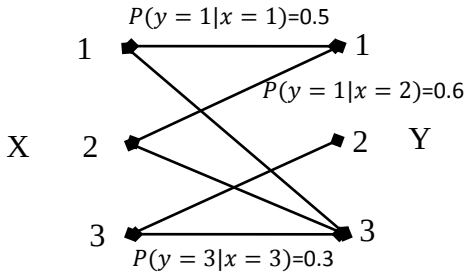
For <u>any</u> three events $S_1, S_1, and\ S_3$:

$$P(S_1 \cup S_2 \cup S_3) = P(S_1) + P(S_2) + P(S_3) + \cdots \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$$

Consider the experiment of throwing two fair dice. What is the probability that the two faces are the same given that the sum is not than three? **(2 points)**

Problem 2: (10 points)

Consider a system that randomly assign a variable X={1,2,3} with uniform probability, to a variable Y={1,2,3}. The conditional probability assignments are shown in the figure. Compute the following:



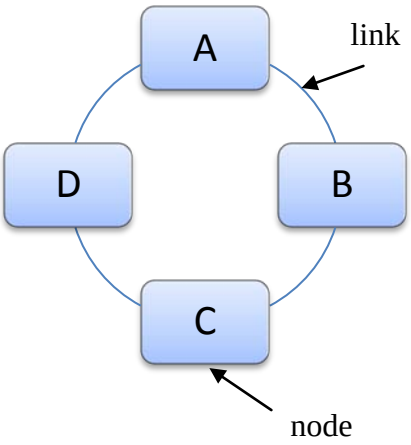
a) If the event y=3 was observed. What is the probability that it is coming from $x = 3$. **(4 points)**

b) Compute the expected value of Y. **(3 points)**

Show that If $P(A|B) > P(A)$ then $P(B|A) > P(B)$ **(3 points)**

Problem 3:

Consider the network with nodes *A*, *B*, *C*, and *D* shown below. A network is connected if a path exists connecting a node to all other nodes. A network is disconnected when two or more links are in failure. If the links are independent and the probability of a link failure is 0,1, compute the probability of the network getting disconnected. **(6 points)**



The pdf of a continuous r.v. *X* is given by

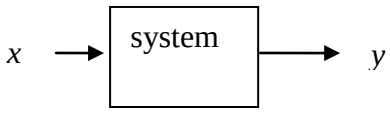
$$f_X(x) = \begin{cases} 1/3 & 0 < x < 1 \\ 3a & 1 < x < 2 \\ 0 & otherwise \end{cases}$$

Find the value of *a* for a valid pdf? **(2 points)**

Sketch the CDF (show all numbers on the *x*-axis and the *y*-axis). *No need for expression only sketch* **(2 points)**

Problem 4:

A noise signal (Random variable *X*) is passed through a system with the following input output relation.



$$y = \begin{cases} -1 & -\infty < x < -1 \\ 0 & -1 \le x \le +1 \\ +1 & 1 < x < \infty \end{cases}$$

X is a Gaussian Random variable, $f_X(x) = \frac{1}{\sqrt{2\pi\sigma_X^2}} e^{-\frac{(x-a_X)^2}{2\sigma_X^2}}$, compute P($y \geq 0$), for the following cases:

a) $a_x = 0 \; and \; \sigma_X = 1$
b) $a_x = 2 \; and \; \sigma_X = 2$
c) $a_x = 1 \; and \; \sigma_X = 2$
d) $a_x = 1 \; and \; \sigma_X = 0$

Gaussian Table:

TABLE B-1

Values of $F(x)$ for $0 \leq x \leq 3.89$ in steps of 0.01

x	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
0.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
0.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
0.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
0.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
0.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
0.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
0.7	.7580	.7611	.7642	.7673	.7704	.7734	.7764	.7794	.7823	.7852
0.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
0.9	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389
1.0	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621
1.1	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8830
1.2	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.9015
1.3	.9032	.9049	.9066	.9082	.9099	.9115	.9131	.9147	.9162	.9177
1.4	.9192	.9207	.9222	.9236	.9251	.9265	.9279	.9292	.9306	.9319
1.5	.9332	.9345	.9357	.9370	.9382	.9394	.9406	.9418	.9429	.9441
1.6	.9452	.9463	.9474	.9484	.9495	.9505	.9515	.9525	.9535	.9545
1.7	.9554	.9564	.9573	.9582	.9591	.9599	.9608	.9616	.9625	.9633
1.8	.9641	.9649	.9656	.9664	.9671	.9678	.9686	.9693	.9699	.9706
1.9	.9713	.9719	.9726	.9732	.9738	.9744	.9750	.9756	.9761	.9767
2.0	.9773	.9778	.9783	.9788	.9793	.9798	.9803	.9808	.9812	.9817
2.1	.9821	.9826	.9830	.9834	.9838	.9842	.9846	.9850	.9854	.9857
2.2	.9861	.9864	.9868	.9871	.9875	.9878	.9881	.9884	.9887	.9890
2.3	.9893	.9896	.9898	.9901	.9904	.9906	.9909	.9911	.9913	.9916
2.4	.9918	.9920	.9922	.9925	.9927	.9929	.9931	.9932	.9934	.9936
2.5	.9938	.9940	.9941	.9943	.9945	.9946	.9948	.9949	.9951	.9952
2.6	.9953	.9955	.9956	.9957	.9959	.9960	.9961	.9962	.9963	.9964
2.7	.9965	.9966	.9967	.9968	.9969	.9970	.9971	.9972	.9973	.9974
2.8	.9974	.9975	.9976	.9977	.9977	.9978	.9979	.9979	.9980	.9981
2.9	.9981	.9982	.9982	.9983	.9984	.9984	.9985	.9985	.9986	.9986
3.0	.9987	.9987	.9987	.9988	.9988	.9989	.9989	.9989	.9990	.9990
3.1	.9990	.9991	.9991	.9991	.9992	.9992	.9992	.9992	.9993	.9993
3.2	.9993	.9993	.9994	.9994	.9994	.9994	.9994	.9995	.9995	.9995
3.3	.9995	.9995	.9996	.9996	.9996	.9996	.9996	.9996	.9996	.9997
3.4	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9998	.9998
3.5	.9998	.9998	.9998	.9998	.9998	.9998	.9998	.9998	.9998	.9998
3.6	.9998	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999
3.7	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999
3.8	.9999	.9999	.9999	.9999	.9999	.9999	.9999	1.0000	1.0000	1.0000