Name: _____ Student I.D. #: _____

EE 364 Midterm Exam Number 1

Wednesday, September 28, 2005

1 hour, 20 minutes – Closed Book; One Two-Sided Crib Sheet; Calculators O.K.

Instructions:

- Verify that your exam contains 9 pages (including this cover sheet).
- Space is provided for you to show your work below each question. Show your work unless otherwise specified. Work is required for partial credit to be awarded.
- Place *one* final answer for each part in the space provided.
- *Cheating will not be tolerated.* The minimum penalty for even casual cheating is a failing grade of 0 on the exam. All instances of cheating will be handled according to university rules and will be reported to the Dean of Student Affairs.
- The point values listed on this exam serve only as a guideline. The instructor reserves the right to make modifications to the weighting of the problems.
- SIMPLIFY all answers to the maximum extent possible

No.	Problem	Points	Score
1.	Short Problems	40	
2.	Educational Values	40	
3.	Making Change	25	
	TOTAL SCORE	105	

Complete as much of the exam as you can in the allotted time – the grades are on a curve

Good Luck!

1 Short Questions (40 Points)

1. **(10 points)** A probability model for the USC football team's season is that each game is won or lost independently of the other games. The probability that a given game is won is 0.9. Given that USC has won their first 3 games, what is the probability that they will win all of their remaining 10 games (denote this as P)?

$P =$ (numerical)

---

2. **(10 points)** A binary word is made up of 8 bits, each taking on the values 0 or 1. If a binary word is selected at random, what is the probability that it will have exactly three 1's

---

$P(\text{Exactly three 1's}) =$ (numerical)

What is the probability that it will have fewer than four 1's?

$P(\text{Fewer than four 1's}) =$ (numerical)

---

3. **(10 points)** Consider three events A, C, and D with $P(A|C) = 1/2$, $P(A|D) = 1/5$, $P(C) = 1/5$, and $P(D) = 2/5$. Also, events C and D are mutually exclusive. Provide an expression for $P(A|C \cup D)$ in terms of the quantities provided. Then, provide the numerical value for this conditional probability.

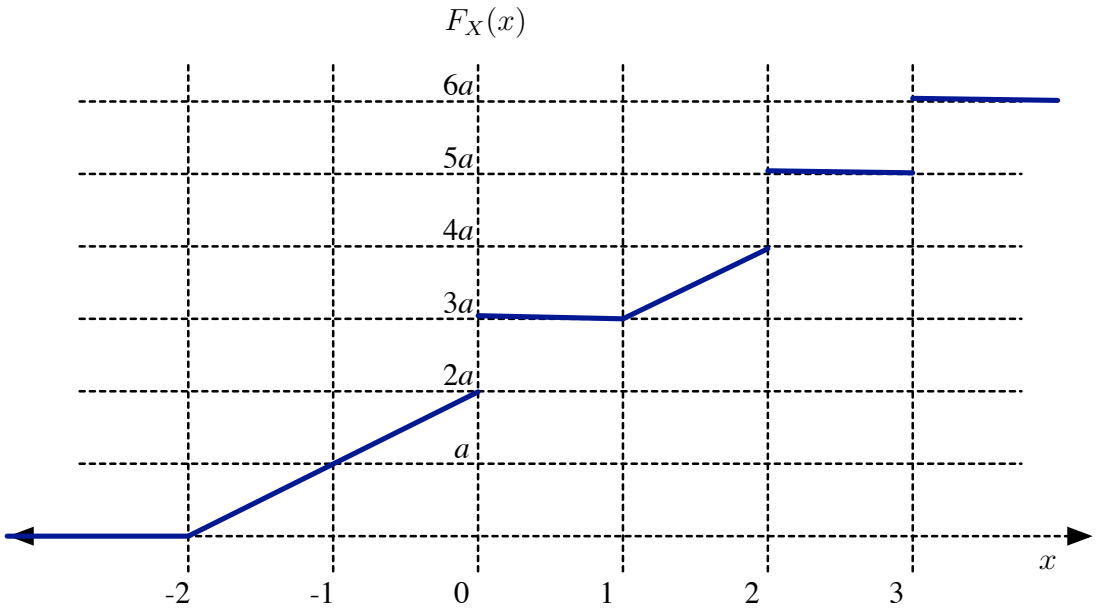
$P(A|C \cup D) =$

(function of $P(A|C)$, $P(A|D)$, $P(C)$, $P(D)$

$P(A|C \cup D) =$ (numerical)

---

4. **(10 points)** Below is the plot of the cdf of $X(u)$:



If $\Pr\{X(u) \leq 3\} = 1$, then determine:

$a =$

$\Pr\{X(u) \leq 2\} =$ $\Pr\{|X(u)| < 2\} =$

$\Pr\{X(u) = 1\} =$ $\Pr\{2.5 \leq X(u) < 3\} =$

$\Pr\{X(u) = 3\} =$

(Numerical)

---

2 Educational Values (40 points)

A study is being conducted in an attempt to correlate quality of education and income level. Engineers who have been in the workforce for at least ten years are categorized according to their income level being one of HIGH, MEDIUM, or LOW. Their undergraduate colleges are also noted and this population is limited to those who graduated from USC, Stanford, or Harvey Mudd College (HMC). Half of this population graduated from USC, ten percent from HMC and the rest graduated from Stanford. For USC graduates, 60% are HIGH income earners and 30% are MEDIUM income earners. Half of Stanford graduates earn HIGH income and 20% earn LOW income. HMC graduates make the most; 90% of HMC graduates earn high income and the rest are equally likely to be LOW or MEDIUM wage earners.

(a) (10 points) What is the probability that an engineer is an HMC graduate and makes a HIGH salary?

P(HMC grad. and HIGH income) = (numerical)

What is the probability that an engineer is an HMC graduate and does not make a LOW salary?

P(HMC grad. and doesn't have LOW income) = (numerical)

(b) (10 points) Determine the probability that an engineer has a LOW, MEDIUM, or HIGH income:

$P(\text{LOW income}) =$ (numerical)

$P(\text{MEDIUM income}) =$ (numerical)

$P(\text{HIGH income}) =$ (numerical)

(c) (10 points) If an engineer has a LOW income, what is the probability that she graduated from Stanford?

$P(\text{Stanford graduate, given LOW income}) =$ (numerical)

(d) (10 points) Suppose that you're given that a particular engineer has a HIGH income and asked to make your best decision as to which school she attended. Describe a strategy for making this decision and then use your strategy to make your best decision.

Strategy for Deciding School:

Decision (circle one): USC Stanford HMC

---

3 Making Change (25 points)

Amy sees 3 quarters, 2 dimes, 1 nickel, and 3 pennies on a table. She will take some of this change and place it in her pocket. Coins of a given amount are not distinguishable.

(a) (10 points) How many different (non-empty) combinations of coins can Amy take?

Number of non-empty combinations = (numerical)

(b) (15 points) How many different (non-zero) amounts of money can Amy take?

Number of non-zero sums of money = (numerical)
