

Colorado State University, Ft Collins

EE 303: Applied Probability
Fall Semester, 2004

Midterm #1
Sept 22, 2004
12:10pm-1:00pm, Wagar 133

Closed Everything

Name: _____

EE: _____ ECE: _____

1. (15) _____

2. (10) _____

3. (10) _____

4. (15) _____

5. (10) _____

Total: (50) _____

1 (15) Skills: Sets and Probability

Begin with the experiment (S, F, P) , and the two sets $A \in F, B \in F$. Assume $0 < P(A) < 1$ and $0 < P(B) < 1$. For each of the following questions, answer True (T) or False (F):

1. Disjoint events A and B are independent. T F
2. If $A \subset B$, then $P(A) < P[B]$. T F
3. In a sequence of 6 Bernoulli trials (coin flips), the sequence $HTHTHT$ is more likely than the sequence $HHHHHH$. T F
4. In a sequence of 6 Bernoulli trials, it is more likely to get 3 heads and 3 tails than 6 heads. T F
5. $P[A \cap B] \leq P[B]$ T F
6. If A and B are dependent, then they may or may not be disjoint. T F
7. $P[A \cup B] \geq P[B]$. T F
8. In a race of 12 equally matched horses, it is as probable to pick the dead last finisher as the winner. T F
9. If A, B are independent then \bar{A}, \bar{B} are independent. T F
10. If $P[A \cup B] = 1$, then $A \cup B = S$. T F
11. If proposition A implies proposition B , then proposition \bar{A} implies proposition \bar{B} . T F
12. $P[A \cup B] \geq P[A] + P[B]$. T F
13. $P[A|B] \geq P[A]$. T F
14. $P[A|B] > P[B]$. T F
15. If the Rules of Poker were faithful to the Laws of Probability, then Two-Pair would beat Three-of-a-Kind. T F

Answers: FFF TTTTTT FFFFFFFF

2 (10) Skills: Drug Testing

Assume 10% of athletes use performance-enhancing drugs. A new drug test correctly returns a positive test with probability 0.80 for a doper and incorrectly returns a positive test with probability 0.20 for a non-doper. What percentage of all tests produce positives?

Answer: $P[+] = P[D, +] + P[\bar{D}, +] = 0.10(0.80) + (0.9)(0.2) = 0.26$ or 26%.

3 (10) Mastery: Polling

Let's say of the 20,000 students at CSU, 52% are women, and 48% are men. In a random draw of 100 students, what is the probability of drawing 52 women?

$$\text{Answer: } \frac{\binom{10400}{52} \binom{9600}{48}}{\binom{20000}{100}}$$

4 (15) Mastery: Two-Out-of-Three

In a sequence of fair games between two players, the first player to win 2 games wins the competition and pockets \$1. Player A wins the first game, at which point the rules committee suspends play and divides up the prize money. How much money should player A collect?

Answer: $P[W|W1] = 1/2 + (1/2)^2 = 0.75$, so Player A should collect \$0.75.

5 (10) Bonus

Eight students assemble at noon to play three on three basketball. How many different match-ups are there?

Answer: $\frac{8!}{3!3!2!2!}$