

MATH 111, Final exam, 12/13/2006**Name:**

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|----|---|---|---|---|----|----|---|---|---|---|---|
| 1 | a | b | c | d | 13 | a | b | c | d | | |
| 2 | a | b | c | d | 14 | a | b | c | d | | |
| 3 | a | b | c | d | 15 | a | b | c | d | | |
| 4 | a | b | c | d | e | 16 | a | b | c | d | |
| 5 | a | b | c | | 17 | a | b | c | d | e | |
| 6 | a | b | c | d | e | 18 | a | b | c | d | |
| 7 | a | b | c | d | e | 19 | a | b | c | | |
| 8 | a | b | c | d | | 20 | a | b | c | d | |
| 9 | a | b | c | d | | 21 | a | b | c | d | e |
| 10 | a | b | c | d | | 22 | a | b | c | d | |
| 11 | a | b | c | d | | 23 | a | b | c | d | |
| 12 | a | b | c | d | | 24 | a | b | c | d | |

1. An individual is chosen at random and the two events F : the individual is female, and S : the individual is a smoker are considered. The event that the individual is a male smoker is

- (a) $F^c \cap S$
- (b) $F^c \cup S$
- (c) $(F \cap S)^c$
- (d) $(F \cup S)^c$

2. A thick and asymmetric coin is tossed and the probability that it lands on the edge is 0.2. If it does not land on the edge, it is three times as likely to show heads as tails. What is the probability that it shows heads?

- (a) 0.2
- (b) 0.4
- (c) 0.5
- (d) 0.6

3. Let A and B be independent events such that $P(A) = 0.4$ and $P(B) = 0.5$. What is $P(A \cup B)$?

- (a) 0.1
- (b) 0.2
- (c) 0.7
- (d) 0.9

4. You roll a die twice and consider the events A : the first roll gives 2, and B : the sum equals 8. What is $P(A|B)$?

- (a) $1/36$
- (b) $5/36$
- (c) $1/6$
- (d) $1/5$
- (e) $2/5$

5. Consider a population where 30% of the people are blonde and 40% are blue-eyed. What is the probability that a randomly chosen person is both blonde and blue-eyed?

- (a) $< 12\%$
- (b) $= 12\%$
- (c) $> 12\%$

6. You have estimated that there is a 5% chance that something is wrong with your car each time you start it. If something is wrong, there is a 75% chance that the "check engine" light comes on. If nothing is wrong, there is still a 10% chance that the light comes on in error. What is the probability that the light comes on when you start your car?

- (a) 5%
- (b) 10%
- (c) 13%
- (d) 50%
- (e) 75%

7. A city has cabs of two colors: 80% of the cabs are blue and 20% are green. A cab is involved in a hit-and-run accident and an eye witness testifies that the cab was green. The witness is tested and found to be able to tell the correct color (classify a green cab as green and a blue cab as blue) under similar lighting conditions about 80% of the time. What is the probability that the cab in the accident was green?

- (a) 20%
- (b) 40%
- (c) 50%
- (d) 60%
- (e) 80%

8. You choose a password by choosing four letters followed by three digits. How many possible such passwords are there if there are no restrictions on how many times each letter or digit can be used.

- (a) $26^4 \cdot 10^3$
- (b) $\binom{26}{4} \cdot \binom{10}{3}$
- (c) $26! \cdot 10!/7!$
- (d) $26 \cdot 25 \cdot 24 \cdot 23 \cdot 10 \cdot 9 \cdot 8$

9. A class consists of 20 girls and 10 boys. If you choose a group 5 students at random, what is the probability that it contains exactly 3 girls?

- (a) 0.008
- (b) 0.15
- (c) 0.36
- (d) 0.67

10. You roll a die 600 times and let x denote the number of 6s. What is $P(90 < x < 110)$?

- (a) 0.698
- (b) 0.702
- (c) 0.726
- (d) 0.750

11. A November 2006 Pew Research Center opinion poll gave President Bush support from 473 of 1,479 randomly chosen Americans. What is the 99% confidence interval for the percentage of supporters in the American population?

- (a) (30.0, 34.0)
- (b) (29.6, 34.4)
- (c) (28.9, 35.1)
- (d) (28.6, 35.4)

12. Opinion polls are done in three different states for the support for a politician. The approval ratings are found to be 30%, 50%, and 90% with the margins of error ME_{30} , ME_{50} , and ME_{90} , respectively. If the three polls have the same sample sizes and the same confidence levels, how do the margins of error relate to each other?

- (a) $ME_{30} < ME_{50} < ME_{90}$
- (b) $ME_{90} < ME_{50} < ME_{30}$
- (c) $ME_{90} < ME_{30} < ME_{50}$
- (d) $ME_{30} < ME_{90} < ME_{50}$

13. The support for a politician is measured in two consecutive opinion polls. The first poll gave support from 672 of 1,200 individuals and the second poll gave support from 711 of 1,250 individuals. What is the 95% confidence interval for the increase in support between the two polls (in percentage points)?

- (a) (-4.2, 6.0)
- (b) (-3.1, 4.8)
- (c) (-2.4, 4.2)
- (d) (1.6, 9.4)

14. The number of misprints per page in a newspaper is a random variable x that can take the values 0, 1, 2, or 3 with probabilities 0.50, 0.05, 0.40, and 0.05, respectively. What is the expected value of x , $E[x]$?

- (a) 0
- (b) 1
- (c) 1.5
- (d) 2

15. You construct a random square by letting its side x be a continuous random variable with expected value $E[x] = 10$. Which of the following statements about the expected area of the square, $E[x^2]$, is true?

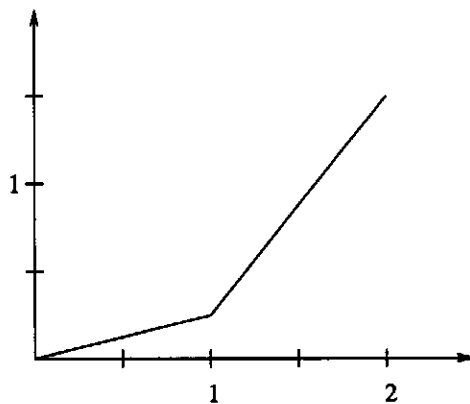
- (a) The expected area is always less than 100.
- (b) The expected area is always equal to 100.
- (c) The expected area is always more than 100.
- (d) It is impossible to choose between (a), (b), and (c) without knowing the distribution of x .

16. Large meteorites hit Earth on average once a millennium. What is the probability that there will be no such hits within the next 500 years?

- (b) 37%
- (b) 50%
- (c) 61%
- (d) 90%

17. The continuous random variable x has range $(0, 2)$ and the pdf shown below. What is the expected value of x , $E[x]$?

- (a) 0
- (b) 0.5
- (c) 1
- (d) 1.5
- (e) 2



18. You have agreed to meet a friend and estimate that your friend's arrival time at the meeting place is uniformly distributed between 1:00 and 1:30. If you arrive at 1:15, what is the probability that you must wait more than five minutes for your friend?

- (a) $1/6$
- (b) $1/4$
- (c) $1/3$
- (d) $1/2$

19. The Old Faithful geyser in Yellowstone National Park erupts on average every 90 minutes. If you arrive at a random time, what is your expected waiting time for the next eruption?

- (a) < 45 minutes
- (b) $= 45$ minutes
- (c) > 45 minutes

20. Suppose that IQ scores in a population follow a normal distribution with mean 100 and standard deviation 15. What is the probability that a randomly chosen individual has an IQ score below 75?

- (a) 0.7%
- (b) 4.8%
- (c) 20.0%
- (d) 95.2%

21. In the previous problem, find the 99th percentile, that is, the IQ score that has 99% of the population below it and 1% above.

- (a) 65
- (b) 115
- (c) 130
- (d) 135
- (e) 145

22. The output voltage of a generator was measured once a day for five days and gave the following data: 213, 215, 220, 221, 224. What is the 95% confidence interval for the unknown mean voltage μ ? You can assume that the voltage follows a normal distribution with unknown standard deviation σ .

- (a) (215, 223)
- (b) (213, 224)
- (c) (212, 226)
- (d) (209, 228)

23. If you want the confidence interval in the previous problem to be half as long, how many days should you measure the voltage (assuming that the sample standard deviation s stays about the same)?

- (a) 2
- (b) 10
- (c) 20
- (d) 25

24. Blood pressures in two populations are compared. A sample of 23 individuals from the first population gave an average (systolic) blood pressure of 150 with a sample standard deviation of 15. In the second population, 15 individuals were tested and gave an average of 130 and a sample standard deviation of 12. Suppose that blood pressures in the two populations follow normal distributions with unknown means and the same unknown standard deviation σ . What is the 90% confidence interval for the difference between the means?

- (a) (9, 31)
- (b) (11, 29)
- (c) (12, 28)
- (d) (13, 27)