STAT*2080 F15
Midterm 2
Nov. 13, 2015

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UNIVERSITY OF GUELPH
MIDTERM 2
VERSION 1

Fall 2015

STAT*2080: APPLIED STATISTICS I

Time Allowed: 60 minutes

Instructor: A. Ali November 13, 2015

INSTRUCTIONS TO CANDIDATES

1. Fill in your name, student ID number, and UoG email user name on the front of the bubble sheet in pencil. Also fill in your name and student number at the bottom of this exam booklet.

2. This midterm contains twenty (20) equally-weighted multiple choice questions and comprises NINE (9) printed pages (including the cover sheets). The Appendix consists of the standard normal table and the binomial table.

3. Answer ALL the questions. The total number of marks for this test is 20. Answer the multiple choice questions on the bubble sheet (it is also wise to circle your answers on the exam paper). There is no "guessing penalty" used in marking this multiple choice exam.

4. Do all your rough work in the exam booklet. However, you must use the bubble sheet provided to answer the questions.

5. There is only ONE correct answer for each question. Fill in only one bubble per question on the bubble sheet.

6. You may use a non-programmable calculator, two double-sided 8.5" × 11" hand-written help sheets, pens and pencils. Use a pencil to submit answers on the bubble sheet.

7. It is recommended that you fill in your answers on the bubble sheet as you go. NO EXTRA TIME will be given to complete this task, and only answers on the bubble sheet will be graded.

8. Return the exam booklet with the bubble sheet included inside.

Student Name: _____

Student ID Number: | | | | | | | |

The next 2 questions refer to the following information. A standard deck of cards has 52 cards with 26 red cards and 26 black cards. The cards are evenly divided into 4 suits: red hearts, red diamonds, black clubs, and black spades, with 13 cards of each suit. Suppose a single card is randomly selected from a well-shuffled deck. Let *A* be the event that the card is an ace. Let *B* be the event that the card is black.

1. Find $P(A \text{ and } B)$.

   (A) 2/52 = 1/26
   (B) 4/52 = 1/13
   (C) 13/52 = 1/4
   (D) 26/52 = 1/2
   (E) None of the above.

2. Find $P(A \text{ or } B^c)$.

   (A) 2/52
   (B) 13/52
   (C) 28/52
   (D) 39/52
   (E) None of the above.

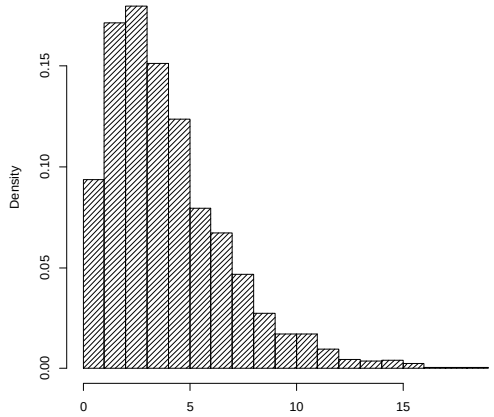
3. Which one of the following pairs of events are disjoint:

   (A) Flip five coins and record top faces. A = {even number of heads}, B = {more than three heads}
   (B) Draw a single card from a shuffled deck. A = {draw a queen}, B = {draw a heart}
   (C) Take a course. A = {pass the course}, B = {fail the course}
   (D) Go to morning class. A = {sleep in} and B = {catch the bus}
   (E) None of the above.

4. Suppose *X* and *Y* are two independent random variables. Which one of the following statements about *X* and *Y* is FALSE?

   (A) The mean of the sum, $X + Y$, is the sum of their means.
   (B) The mean of the difference, $X - Y$, is the difference of their means.
   (C) The correlation between *X* and *Y* is zero.
   (D) The variance of the sum, $X + Y$, is the sum of their variances.
   (E) The variance of the difference, $X - Y$, is the difference of their variances.

5. The following histogram shows the distribution of the random variable X in a population with mean $\mu = 4$ and variance $\sigma^2 = 8$.



Suppose a simple random sample of 100 observations is to be selected from the population and the sample average, $\bar{X}$, calculated. Which one of the following statements about the distribution of $\bar{X}$ is FALSE?

(A) The distribution of $\bar{X}$ will have a mean of 4.
(B) The distribution of $\bar{X}$ will be highly skewed to the right.
(C) The distribution of $\bar{X}$ will be approximately normal.
(D) The distribution of $\bar{X}$ will be approximately symmetric around $\mu = 4$.
(E) The variance of the distribution of $\bar{X}$ will be 0.08.

6. Andy's toy garage can hold up to four cars. Let X be the number of cars actually in the garage at any given time. According to Andy, X follows the distribution shown below, with mean $\mu = 3.83$ cars. What is the standard deviation of X? Choose the option closest to your answer.

x	0	1	2	3	4
$P(X = x)$	0	0.02	0.03	0.05	0.90

(A) 0.14
(B) 0.32
(C) 0.49
(D) 0.57
(E) 0.63

The next two questions refer to the following information. Let X be a random variable that follows the distribution shown below, where c is a constant.

x	0	1	2	3	4
$P(X = x)$	0.05	0.25	0.30	c	0.10

7. Find the expected value of X. Choose the option closest to your answer.

   (A) 1.73
   (B) 2.00
   (C) 2.15
   (D) 2.74
   (E) 3.06

8. Find $P(0 < X < 3)$. Choose the option closest to your answer.

   (A) 0.55
   (B) 0.60
   (C) 0.75
   (D) 0.85
   (E) 0.90

9. The gestation period for pregnant women is approximately normally distributed with mean $\mu = 282$ days and standard deviation $\sigma = 11$ days. Births with gestation period of 258 days or less are considered to be premature births. What is the probability that two randomly selected pregnant women both give birth to premature babies?

   (A) 0.0002
   (B) 0.0146
   (C) 0.0292
   (D) 0.1208
   (E) None of the above.

10. Fill in the blank. A red die and a green die are rolled and the top face of each die is recorded. Let R be the event that the number on the red die is three or less, and G be the event that the number on the green die is more than three. The events R and G are _____.

(A) Disjoint.
(B) Complements.
(C) Independent.
(D) Reciprocals.
(E) Mutually exclusive.

The next 2 questions refer to the following information. Suppose electronic devices found on campus over the last semester were found either in a cafeteria or in a classroom. All such devices found are sent to a central lost and found. The table below provides the joint distribution for the type of device lost and the location where it was found. Assume this population is very large.

Location	**Device Lost**		
Found	Cell phone	Tablet	Laptop
Cafeteria	0.36	0.06	0.02
Classroom	0.43	0.12	0.01

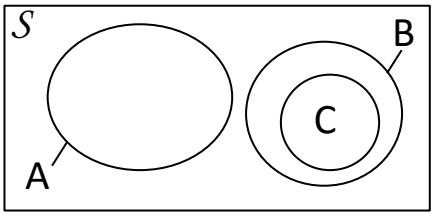
11. Suppose an electronic device is randomly selected from this population. Given that the device lost is a cell phone, what is the probability that it was found in a cafeteria? Choose the option closest to your answer.

(A) 0.36
(B) 0.46
(C) 0.79
(D) 0.82
(E) 0.94

12. Suppose two electronic devices are randomly selected from this population. What is the probability that both devices are tablets? Choose the option closest to your answer.

(A) 0.004
(B) 0.014
(C) 0.032
(D) 0.180
(E) 0.194

13. Consider the Venn diagram shown below, which depicts the relationship between events *A*, *B*, and *C*.



Which one of the following is equal to $P(A \cup B \cup C)$?

(A) $P(A) + P(B) + P(C)$
(B) $1 - P(C)$
(C) $P(A) + P(B) + P(C) - P(A)P(C)$
(D) $P(A) + P(B) - P(C)$
(E) $P(A) + P(B)$

The next 2 questions refer to the following information. It is estimated that 75% of all young Canadian adults between the ages of 18-35 do not have a landline in their homes and only use a cell phone at home.

14. What is the standard deviation for the number of young adults who do not own a landline in a simple random sample of size 100?

(A) 0.43
(B) 4.33
(C) 18.75
(D) 25.00
(E) None of the above.

15. In a random sample of 12 young adults from the population, what is the probability that more than 10 young adults own a landline? Choose the option closest to your answer.

(A) Less than 0.01
(B) 0.04
(C) 0.10
(D) 0.16
(E) 0.40

The next two questions refer to the following information. The weights of eggs at a particular poultry farm are well-modelled by a normal distribution with a mean of 53.6 g and a standard deviation of 4.8 g. Eggs are randomly selected and placed in cartons. Consider a single carton of a dozen (12) eggs randomly selected from the population.

16. What is the probability that the sample mean weight of eggs in a carton is greater than 56.0 g? Choose the option closest to your answer.

(A) < 0.01
(B) 0.042
(C) 0.083
(D) 0.106
(E) 0.319

17. What are the mean and standard deviation for the <u>total weight</u> of all dozen eggs in a carton?

(A) $\mu =$ 53.6 g, $\sigma =$ 4.8 g
(B) $\mu =$ 53.6 g, $\sigma =$ 16.6 g
(C) $\mu =$ 643.2 g, $\sigma =$ 1.4 g
(D) $\mu =$ 643.2 g, $\sigma =$ 4.8 g
(E) $\mu =$ 643.2 g, $\sigma =$ 16.6 g

18. How many of the following are situations in which a binomial distribution is appropriate?

i. The number of tosses of a die until a 5 comes up on the top face.
ii. The number of people with more than $10,000 of consumer debt in a random sample of 120 Canadians.
iii. The number of family members in a household of 6 who have good eating habits.
iv. The number of tosses of two dice for which the sum of the top faces is odd out of 10 tosses of the pair of dice.

(A) 0
(B) 1
(C) 2
(D) 3
(E) 4

19. Suppose independent random variables X and Y are normally distributed. Which one of the following explains why $W = X + Y$ is also normally distributed?

(A) Law of Large Numbers
(B) Central Limit Theorem
(C) Empirical Rule
(D) Statistical theory states that the sum of independent normal random variables is normal.
(E) Simpson's Paradox

20. Suppose that for double-income households, the annual income of Spouse 1 has mean \$30,000 and standard deviation \$5,000. The annual income of Spouse 2 has mean \$50,000 and standard deviation \$8,000. Annual incomes between spouses tend to be positively correlated with $\rho = 0.55$. Find the standard deviation for total annual household income. Choose the option closest to your answer.

(A) \$ 3,000
(B) \$ 9,500
(C) \$11,500
(D) \$13,000
(E) \$20,000

– END OF EXAM –