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University of Guelph
Department of Mathematics and Statistics

STAT*2040: Statistics I
Test 1

VERSION 2
Gray Computer Card

Instructor: G. J. Umphrey

19 October, 2009
Time: 75 minutes

NOTES

1. This is a closed book examination, but one 8.5"×14" crib sheet (double sided) and a calculator are allowed.

2. This test consists of 20 equally-weighted multiple choice questions. Answer the multiple choice questions on the computer score sheet (it is also wise to circle your answers on the exam paper). There is no "guessing penalty" used in marking the multiple choice.

3. Make sure you have a complete exam booklet!

4. Fill in your student ID and section number on the front of the computer score sheet in pencil. Also fill in your name and student number at the top of this exam booklet.

5. **The entire exam booklet is to be handed in, including your rough work, along with the computer score sheet.**

1. Which one of the following is a qualitative variable?
   (A) The volume of a tumour.
   (B) The sex of a pig.
   (C) The time it takes for a female black widow spider to cannibalize her mate.
   (D) The concentration of gold in a sample of gold ore.
   (E) The number of eggs laid by a female fruit fry.

2. If $P(A) = 0.40$, $P(B) = 0.60$, and A and B are independent, what is $P(A' \cap B)$?
   (A) 0.16
   (B) 0.24
   (C) 0.36
   (D) 0.84
   (E) None of the above.

Note: The next two questions are based on the following information.

A biologist studying pollination ecology obtained the following data on the visits of two bee species to three flower species.

	Flower Species1	Flower Species 2	Flower Species 3	Total
Bee Species 1	248	176	68	492
Bee Species 2	45	14	244	303
Total	293	190	312	795

3. If a randomly selected visit from this sample is not to Flower Species 3, what is the probability that the visit was made by Bee Species 2?
   (A) 59/303
   (B) 59/424
   (C) 59/483
   (D) 59/795
   (E) None of the above.

4. For a randomly selected visit from this sample, define F_1, F_2, and F_3 to be the events that the visit is to Flower Species 1, 2, and 3, respectively. Also define B_1 and B_2 to be the events that the visit was made by Bee Species 1 and 2, respectively. The ratio 176/795 would represent which one of the following probabilities?
   (A) $P(B_1 \cap F_2)$
   (B) $P(B_1 \cup F_2)$
   (C) $P(F_2 \mid B_1)$
   (D) $P(B_1 \mid F_2)$
   (E) None of the above.

5. What is a Pareto diagram?
   (A) a cumulative relative frequency polygon
   (B) a special type of pie chart
   (C) a bar chart where the bars are ordered from highest to lowest
   (D) a type of bivariate scatter plot where the size of the points used varies
   (E) a histogram where frequencies are given on the left Y-axis and relative frequencies on the right Y-axis.

6. The mutually exclusive events A and B each occur with nonzero probability. Under what conditions are A and B independent?
   (A) always
   (B) only when $P(A) = P(B)$
   (C) only when $P(A) \neq P(B)$
   (D) only for certain values of P(A) and P(B) not covered by options (B) or (C)
   (E) never

7. Events A and B are mutually exclusive but not complements, with $P(A) = 2P(A') = 6P(B)$. What is $P(A' \cap B')$?
   (A) 1/9
   (B) 2/9
   (C) 1/7
   (D) 2/7
   (E) None of the above.

8. What is the sample standard deviation for the following data set? [Hint: Pick closest value, and use your calculator's appropriate standard deviation function to be efficient.]

   −172.46, −184.68, −92.76, −142.05, 12.72

   (A) 71.68
   (B) 80.14
   (C) −71.68
   (D) −80.14
   (E) The sample standard deviation is not within 2 of any of the values in (A) to (D).

NOTE: The next two questions refer to the information in the following table.

A frequency table was constructed for a sample of $n = 50$ observations. Two columns for the table are given below.

Class Limits	Frequency
15–25	4
25–35	7
35–45	11
45–55	13
55–65	15

9. The relative frequency for the class with midpoint 40 is:
   (A) 0.11
   (B) 0.22
   (C) 0.33
   (D) 0.44
   (E) None of the above.

10. The median for this grouped data falls in the class with class limits:
   (A) 15–25.
   (B) 25–35.
   (C) 35–45.
   (D) 45–55.
   (E) 55–65.

11. “Texas hold ‘em” is a popular form of poker that starts with each player being dealt two cards (“hole cards”). If you were playing a game of “Texas hold ‘em”, what is the probability you will be dealt an ace and a king (any order, and assume random dealing) as your “hole cards”?
    (A) 1/169
    (B) 2/169
    (C) 4/663
    (D) 8/663
    (E) None of the above.

12. Two growers supply all of the watermelons to a large grocery store. Grower 1 provides 80% of the watermelons, and Grower 2 the rest. When opened, some watermelons prove to be substandard, as they are either under-ripe or over-ripe. Four percent of watermelons supplied by Grower 1 are substandard, while only two percent of watermelons supplied by Grower 2 are substandard. If you buy a watermelon from the store (consider it a “randomly sampled” watermelon) and discover it is substandard, what is the probability it comes from Grower 2?
    (A) 1/5 = 0.200.
    (B) 1/7 = 0.143.
    (C) 1/9 = 0.111.
    (D) 1/11 = 0.091.
    (E) 1/13 = 0.077.

13. Consider a variant of the "Let's Make a Deal" game, where instead of there being three doors, there are four. As in the original game, there is a car behind one door, and goats behind the other doors. You select a door, and the host now opens two of the three doors that you didn't select. The host knows what is behind each door, and both doors opened always have goats behind them. You are offered the opportunity to switch doors. If you switch doors the probability you will win the car is:
    (A) 1/2
    (B) 2/3
    (C) 3/4
    (D) 3/5
    (E) 4/5

14. When a fair coin is tossed repeatedly and the proportion of heads is plotted against the number of tosses, we will almost certainly see that variation in the sample proportion about a value of 0.5 declines as the number of tosses increases. This phenomenon is a result of:
    (A) manipulation of the flips to ensure long-run equality of heads and tails.
    (B) the tendency of a coin to compensate for an excess of heads or tails in the short run by producing an excess of outcomes of the other coin side to balance out the ratio.
    (C) the Law(s) of Large Numbers, where early chance fluctuations are diluted by the outcomes on further repeated flips.
    (D) a "memory" property of coin flips, which states that independence is overridden by the need for balanced outcomes.
    (E) the phenomenon is not correctly stated, the variation in the sample proportion doesn't decline as the number of tosses increases.

15. The two "AA" batteries in Jennifer's flashlight have died. She keeps a box with fresh "AA" batteries; unfortunately there are three dead batteries mixed in with the seven good batteries. She has a battery tester to help her find two good batteries. If she picks batteries at random from the box, what is the probability she will not need to test more than three batteries to find two good batteries?
    (A) $7/20 = 0.35$
    (B) $21/40 = 0.525$
    (C) $77/120 \simeq 0.642$
    (D) $49/60 \simeq 0.817$
    (E) None of the above.

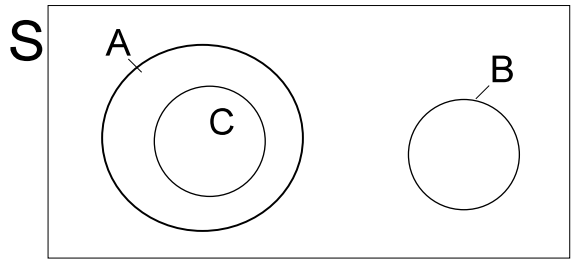
16. Which one of the following events <u>is equivalent to</u> the event $(A' \cup B)$?
    (A) $(A \cup B')$
    (B) $(A \cup B')'$
    (C) $(A \cap B')$
    (D) $(A \cap B')'$
    (E) None of the above.

17. A probability experiment is conducted where two fair dice are rolled. Define: A is the event that the sum is at least 3 and B is the event that the sum is less than or equal to 4. Events A and B are:
    (A) independent.
    (B) complements.
    (C) mutually exclusive but not complements.
    (D) one event is a subset of the other.
    (E) dependent but not mutually exclusive and neither is one event a subset of the other.

18. An urn contains 3 red balls and 2 white balls. A ball is drawn at random and replaced by a ball of the other colour (that is, if a red ball is drawn, it is replaced by a white ball, and if a white ball is drawn, it is replaced by a red ball). Another ball is then drawn at random from the urn. What is the probability that the second ball drawn is red ?
    (A) 2/5
    (B) 3/5
    (C) 1/2
    (D) 9/25
    (E) 14/25 [Corrected]

Note: The next two questions are based on the following information.

The diagram below (sometimes called a Venn diagram, more properly a Euler diagram) depicts the relationship of the three events A, B and C. Note the circle depicting C is within the circle depicting A.



19. Which one of the following statements is false?
    (A) Events A and B are mutually exclusive but not complements.
    (B) Events B and C are mutually exclusive but not complements.
    (C) Events C and $(A' \cap B')$ are mutually exclusive but not complements.
    (D) Event $(A \cap C')$ is a subset of B'.
    (E) Event $(B \cup C)$ is a subset of A'.

20. $P(A \cup B \cup C) =$
    (A) $P(A) + P(B) + P(C)$
    (B) $P(A) + P(B)$
    (C) $P(A) + P(B) + P(C) - P(A)P(C)$
    (D) $P(A) + P(B) - P(C)$
    (E) None of the above.