MAT 307: Exam 1
Spring – 2023
03/03/2023
85 Minutes

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Write your name on the appropriate line on the exam cover sheet. This exam contains 15 pages (including this cover page) and 50 questions. Check that you have every page of the exam. Indicate your answer for each question in the answer column in the table below. You need not indicate your answers for each question both on the cover page and in the subsequent pages. You may show as much or as little work as you would like; however, only the answers on this cover page will be graded. Be sure each answer is legible and in the correct box. Do not write in the 'Points' box on this page.

Question	Answer	Question	Answer	Question	Answer	Question	Answer	Question	Answer
1	D	11	C	21	B	31	B	41	D
2	C	12	A	22	C	32	C	42	B
3	A	13	D	23	C	33	A	43	D
4	B	14	C	24	D	34	C	44	A
5	A	15	C	25	A	35	B	45	C
6	C	16	B	26	C	36	C	46	B
7	A	17	C	27	D	37	C	47	C
8	A	18	D	28	A	38	C	48	A
9	C	19	B	29	B	39	B	49	A
10	D	20	B	30	D	40	B	50	C

Points	Total
	50

1. Let $A = \{1, 2, 3, 4, 5\}$ and $B = \{3, 4, 5, 6, 7\}$. Which of the following is $A \cup B$?
   A. $\{4, 5\}$
   B. $\{3, 4, 5\}$
   C. $\{1, 2, 6, 7\}$
   D. $\{\mathbf{1}, \mathbf{2}, \mathbf{3}, \mathbf{4}, \mathbf{5}, \mathbf{6}, \mathbf{7}\}$

2. How many possible unique arrangements of letters are there using the letters of the word 'endless'?
   A. 7
   B. 21
   C. 1260
   D. 5040

3. If you are dealt five cards from a deck of cards, approximately what is the probability that you are dealt four kings?
   A. 0.00002
   B. 0.019
   C. 0.077
   D. 0.307

4. Alice and Bob take an exam. Alice received a 79 on her exam while Bob received a 67 on his exam. Alice's exam was normally distributed with mean 85 and standard deviation 1.5 while Bob's exam was normally distributed with mean 60 and standard deviation 5. Which of the following statements is most accurate?
   A. Alice did better on her exam compared to others but Bob's score was more 'unusual' compared to others.
   B. Bob did better on his exam compared to others but Alice's score was more 'unusual' compared to others.
   C. Alice's exam score was better compared to others and her exam score was more 'unusual' compared to others.
   D. Bob's exam score was better compared to others and his exam score was more 'unusual' compared to others.

5. Let $A = \{10, 1, 5, 4, 6\}$ and $B = \{3, 5, 0, -2, 6\}$. Which of the following is the set $A - B$?

   A. $\{\mathbf{1}, \mathbf{4}, \mathbf{10}\}$

   B. $\{7, -4, 5, 6, 0\}$

   C. $\{-4, 0, 5, 6, 7\}$

   D. $\{-2, 0, 1, 3, 4, 10\}$

6. Mr. Lambert has 40 students in his classroom. Of these students, 13 have been to a zoo, 15 have been to a museum, and 5 have been to both. Which of the following is the number of students that have been to neither?

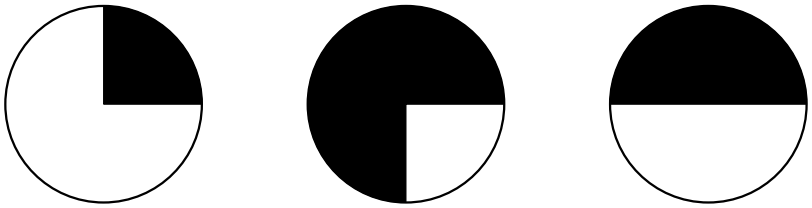
   A. 7

   B. 12

   C. 17

   D. 35

7. There are three spinners, shown below with portions of each spinner colored white or black.



   If you spin each of these three spinners, one after the other, what is the probability that each spinner lands in the dark shaded area?

   A. 0.09375

   B. 0.50000

   C. 0.66667

   D. 0.75000

8. Let S be the set of counting numbers from 1 to 100 (including 1 and 100). Suppose you found the mean, median, IQR, and standard deviation of S. Which of the following statements is most accurate if you were to compute these statistics after including the number 1,200 in the set S?

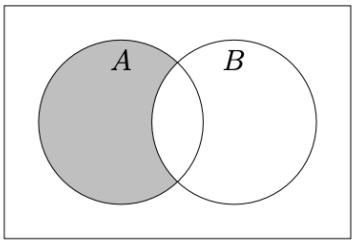
   A. The mean would change more than the median.

   B. The median would change more than the mean.

   C. The mean and median would change by the same amount.

   D. The mean would change but the median would not.

9. Which of the following represents the region shaded in the Venn diagram below?



A. A

B. $A \cap B$

C. $\mathbf{A - B}$

D. $(A \cup B) - (A \cap B)$

10. Samantha, Timothy, Ben, and Justin are lining up at the cafeteria for lunch. How many arrangements are there for them to line up?

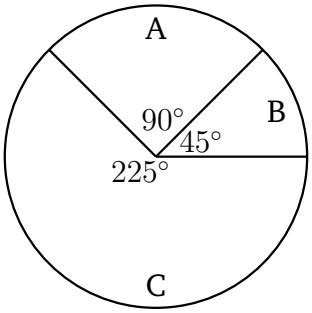
A. 1

B. 4

C. 10

D. 24

11. Shown below is a spinner with different regions labeled, as well as the angles used to form those regions.



If you spin this wheel, what is the probability that the spinner lands in the region labeled 'C'?

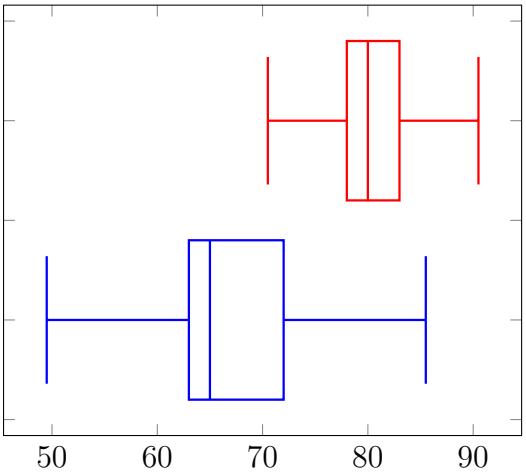
A. $\frac{1}{2}$

B. $\frac{2}{3}$

C. $\frac{5}{8}$

D. $\frac{7}{8}$

12. Below are box plots for the exam scores for students in a Mathematics class, broken down by gender. The women are represented by red and men by blue.



Which of the following statements is most accurate?

A. On average, the women did better and the men had more varied scores.

B. On average, the men did better and the women had more varied scores.

C. On average, the women did better and the men had less varied scores.

D. On average, the men did better and the women had less varied scores.

13. Let C be the set of cars, O be the set of objects that were made more than five years ago, and R be the set of red objects. Which of the following best describes an element of $(C \cap O^c) \cup (C \cap R)$?

A. A red car that was made more than 5 years ago.

B. A red car that was made less than 5 years ago.

C. A red car or a car made more than 5 years ago.

D. A red car or a car made less than 5 years ago.

14. How many passwords with 6 characters can be made using the first five letters of the alphabet and the numbers 0–4?

A. 10

B. 531,441

C. 1,000,000

D. 3,628,800

15. Suppose you give a weekend tour at your college. You ask each of the students how many colleges they have visited and whether they plan to enroll as a part or full time student. The summary of the data you gathered is given below.

	One College	Two Colleges	Three or More
Full Time	3	4	8
Part Time	5	6	1

If you randomly selected a student that was on the tour, what is the probability that they were planning on being full time and had visited more than one college?

A. 0.148

B. 0.296

C. $\mathbf{0.444}$

D. 0.800

16. Which of the following would not be appropriate to use to represent the set of average monthly temperatures from January 2000 to December 2019?

A. A dot plot.

B. A bar graph.

C. A stem-and-leaf plot.

D. A histogram.

17. Which of the following is the cardinality of the set of even numbers from 10 to 620 (including 0 and 100)?

A. 290

B. 305

C. 306

D. 610

18. How many six-digit numbers have exactly one seven in their digits?

A. 7,290

B. 100,000

C. 142,857

D. 321,489

19. Suppose you give a weekend tour at your college. You ask each of the students how many colleges they have visited and whether they plan to enroll as a part or full time student. The summary of the data you gathered is given below.

	One College	Two Colleges	Three or More
Full Time	3	4	8
Part Time	5	6	1

If you randomly selected a student that was on the tour, assuming they had visited more than one college, what is the approximate probability they planned on being a full time student?

A. 0.444

B. 0.632

C. 0.703

D. 0.815

20. Robert calculates that, on average, they make $47.50 in profit for each person that attends one of the baseball games at the stadium where he works. If there were 8,400 people that attended the last game, approximately how much profit did the stadium make?

A. $8,400

B. $399,000

C. $420,000

D. $1,500,000

21. If $A = \{a, b, a, c, d, e\}$ and $B = \{a, b, e, e\}$, which of the following is the set $A \cap B$?

A. $\{a, a, b\}$

B. $\{\mathbf{a}, \mathbf{b}, \mathbf{e}\}$

C. $\{a, a, b, d, e, e\}$

D. None of the above

22. What is the cardinality of the set $A = \{1, 1, 2, 2, 3, 3, \ldots, 10, 10\}$?

A. 4

B. 8

C. 10

D. 20

23. The chart below summarizes the number of students, broken down by gender, that enjoy Christmas, Thanksgiving, or neither of those two as their favorite holiday.

	Christmas	Thanksgiving	Neither
Boy	6	4	2
Girl	5	3	8

If you select one of these children at random, what is the probability that they liked Thanksgiving best, assuming you selected a boy?

A. 0.143

B. 0.250

C. 0.333

D. 0.571

24. Which of the following is not a measure of 'averageness' for a set of data?

A. Mean

B. Median

C. Mode

D. Standard Deviation

25. Let N be the set of numbers from 1 to 30 (including 1 and 30) and T be the set of multiples of 2 or 3. What is $|N - T|$?

A. 10

B. 15

C. 20

D. 25

26. Charlie is going to invite four friends to go with him on a camping trick. He has seven friends that are interested in the trip. How many possible groups of friends can he invite to go on the trip?

A. 7

B. 24

C. 35

D. 5,040

27. Peter works with a small research group of 30 people. In the group, there are ten people that work in Mathematics and fifteen that work in Biology with four researchers that work in both areas. What is the probability that if you randomly select on of the researchers that they either work in neither or both Mathematics and Biology.

    A. $\frac{1}{6}$
    B. $\frac{3}{10}$
    C. $\frac{1}{3}$
    D. $\mathbf{\frac{13}{30}}$

28. Gloria works at a company whose salaries are normally distributed with mean \$50,000 and standard deviation \$18,000. Approximately percent of works earn more than \$65,000 at the company?

    A. 20.3%
    B. 68.8%
    C. 79.7%
    D. 83.3%

29. Suppose that $A = [-10, 50)$ and $B = (0, 100)$. Which of the following is $A \cap B$?

    A. $[-10, 100)$
    B. $(\mathbf{0}, \mathbf{50})$
    C. $[0, 50)$
    D. $[0, 50]$

30. Fifteen different businesses are under consideration for an award for 'Best Business in Scranton.' The organization responsible for the award will choose one winner and one different team for an honorable mention. How many different choices do they have for these two awards?

    A. 2
    B. 15
    C. 105
    D. 210

31. Suppose you roll a die three times. Approximately what is the probability that you roll at least one three?

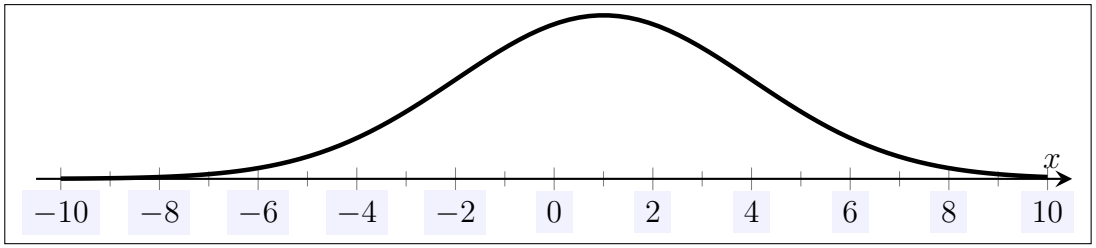
    A. 0.005

    B. 0.421

    C. 0.579

    D. 0.995

32. Consider the normal distribution plotted below.



    Which of the following are most likely the mean and standard deviation for this distribution?

    A. $\mu = 1$, $\sigma = 1$

    B. $\mu = 3$, $\sigma = 1$

    C. $\mu = 1$, $\sigma = 3$

    D. $\mu = 6$, $\sigma = 1$

33. Suppose that $A = \{a, a, b, c, c, d, e, e\}$ and $B = \{a, b, d, e, f, g, h, a\}$. Which of the following is the cardinality of $A \cup B$?

    A. 8

    B. 12

    C. 13

    D. 16

34. A very large number of orange soda, grape soda, and cherry soda are on a table. You are going to take three sodas to take back to your friends. How many different ways can you choose the three sodas?

    A. 1

    B. 6

    C. 10

    D. 27

35. Suppose that you roll a pair of die. What is the probability that you roll a four and a six?

    A. $\frac{1}{36}$
    B. $\frac{1}{18}$
    C. $\frac{1}{6}$
    D. $\frac{1}{3}$

36. The lengths (in inches) of various leaves was gathered by students working in the field. Their data is given below.

    $$1.6 \quad 2.1 \quad 1.8 \quad 2.4 \quad 1.9 \quad 2.8 \quad 2.6 \quad 1.9 \quad 2.0 \quad 2.6$$

    Using the median as a measure of center, which of the following possible leaf lengths (in inches) would not represent an outlier given this data.

    A. 0.6
    B. 0.8
    C. 3.5
    D. 3.8

37. Which of the following numbers is an element of the set $S = \{3n+8 \colon n \text{ is an positive integer}\}$?

    A. 2
    B. 8
    C. 20
    D. 25

38. You have six different paintings from two different artists. One artist contributed four paintings while another contributed two. How many different orders can you hang them up on the wall if each artist must have a painting on either the far left or far right in the arrangement?

    A. 48
    B. 192
    C. 384
    D. 720

39. You have a bag filled with 12 red marbles and 8 blue marbles. Suppose you reach into the bag, grab a marble, and then set it aside a total of three times. What is the approximate probability that all three marbles were blue?

    A. 0.042

    B. 0.049

    C. 0.064

    D. 0.40

40. Jose has been gathering data on the amount of snowfall in his local community. He reads off the snow levels using a ruler attached to a wall outside his classroom. He finds the mean and standard deviation for the data he gathered. However, after performing this computation, he realizes that the ruler was 0.2" above the ground. If Jose corrects this error in his data, what will happen to the mean and standard deviation for his data?

    A. The mean and standard deviation will decrease.

    B. The mean will decrease, but the standard deviation will stay the same.

    C. The mean will decrease, but the standard deviation will increase.

    D. The mean will stay the same, but the standard deviation will decrease.

41. Let P be the set of all prime numbers and O be the set of all odd numbers. Which of the following is true?

    A. $P \subseteq O$

    B. $O \subseteq P$

    C. $P = O$

    D. $\mathbf{P \neq O}$

42. How many different arrangements are there using the letters of the word 'field' if the arrangement must start and end with a vowel?

    A. 6

    B. 12

    C. 60

    D. 120

43. You interview 25 children about whether they like swimming or riding their bike. Of these children, two say they only enjoy swimming, five say they only enjoy biking, and ten say they do not enjoy swimming nor biking. If you select a child that you interviewed at random, what is the probability that they enjoyed swimming or biking?

    A. 0.28

    B. 0.40

    C. 0.60

    D. 0.68

44. Consider the data values given below.

    $$0 \quad 20 \quad 10 \quad 50 \quad 40 \quad 10$$

    Which of the following is the correct ordering for this data?

    A. mode $<$ median $<$ mean

    B. median $<$ mean $<$ mode

    C. mean $<$ median $<$ mode

    D. mode $<$ mean $<$ median

45. Let H be event that a randomly selected person in the United States has bought a home. Let Y be the event that a randomly selected person in the United States is under 30 years old. Which of the following is most correct?

    A. The events H and Y are mutually exclusive but not independent.

    B. The events H and Y are mutually exclusive and independent.

    C. The events H and Y are not mutually exclusive and not independent.

    D. The events H and Y are not mutually exclusive but are independent.

46. Consider the data given below.

    $$8 \quad 9 \quad 10 \quad 11 \quad 11 \quad 11 \quad 12 \quad 14 \quad 19$$

    Which of the following is the 5-number summary for this dataset?

    A. 8, 9, 11, 14, 19

    B. 8, 9.5, 11, 13, 19

    C. 8, 10, 11, 12, 19

    D. 8, 10.5, 11, 11.5, 19

47. The chart below summarizes the number of students, broken down by gender, that enjoy Christmas, Thanksgiving, or neither of those two as their favorite holiday.

	Christmas	Thanksgiving	Neither
Boy	6	4	2
Girl	5	3	8

If you select one of these children at random, what is the approximate probability that they are a girl or their favorite holiday is Thanksgiving?

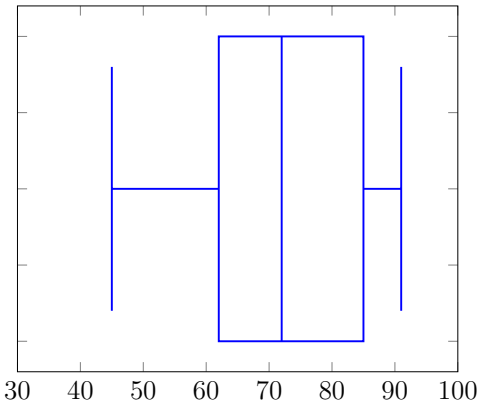
A. 0.107

B. 0.607

C. 0.714

D. 0.857

48. Consider the box and whisker for a set of data that is given below.



Which of the following is most likely the median and IQR for this dataset?

A. median= 72, IQR= 23

B. median= 72, IQR= 12

C. median= 75, IQR= 23

D. median= 75, IQR= 12

49. If A and B are subsets of the same set, which of the following must be the same as $A - B$?

A. $\mathbf{A \cap B^c}$

B. $(A \cap B)^c$

C. $A \cap B$

D. $A^c \cup B^c$

50. If A is an event that occurs with probability 0.20 and B is an event that occurs with probability 0.35. Which of the following is not a possible value for the probability that A and B both occur?

    A. 0.10

    B. 0.20

    C. 0.60

    D. Cannot be determined with the given information.