Practice Problems for the Final Examination

(Final on Dec. 15)

Math 125, Fall 2023

Multiple Choice. 5 points for each correct response, 1 point deducted for each wrong answer

For Problems 1, 2, and 3

Number of medals	0	1–2	3–5	6	7	8–11	12–15	16–20	21–30
Percent of scouts	5	8	21	6	5	20	24	6	5

Consider the histogram based on the above table for scouts in a certain Boy Scout Council. It will show the distribution of scouts by number of medals.

1. The units on the horizontal scale are:

(A) number of scouts (B) number of medals (C) % of scouts (D) area (E) percent of scouts per medal

2. The height of the block for 12 to 15 medals is:

(A) 3 medals (B) 4 medals (C) 6 percent per medal (D) 8 percent per medal (E) 24%

3. The endpoints of the base of the block for 8 to 11 medals are:

(A) 8 and 11 (B) 7.5 and 11.5 (C) 8.5 and 11.5 (D) 7 and 12 (E) 8 and 12 7 and 11

For Problems 4, 5, and 6.

A large class has 240 students. A histogram is to be made to show their distribution by age. In the category of 35 to 40 years, there are 36 students. This category includes all those whose stated age is 35, all the way up and including all those whose stated age is 40.

4. The endpoints of the base of the block for 35 to 40 are:

(A) 35 and 40 years (B) 35 and 41 years (C) 34.5 and 39.5 years
(D) 34.5 and 40.5 years (E) 35.5 and 39.5 years

5. The height of that block for 35 to 40 is:

(A) 15% (B) 15% per year (C) 2.5% per year (D) 3% per year (E) 6% per year (F) 12% per year

6. The vertical scale is a _____ scale.

(A) measurement (B) percent (C) density (D) propensity (E) counting

For Problems 7, 8, 9, and 10.

For a large group of women, a histogram is to be made to show their distribution by height. The heights are rounded off to the nearest whole number. In the category of 72 to 77 inches (all women whose height was rounded off to 72 to 77 inclusive) were 6% of the group.

7. The endpoints of the base of the block for 72 to 77 inches, inclusive, are:

(A) 72 and 77 inches (B) 71.5 and 76.5 inches (C) 72.5 and 77.5 inches
(D) 71.5 and 77.5 inches (E) 72.5 and 76.5 inches (F) 71 to 78 inches

8. The height of that block for 72 to 77 is:

(A) 6% (B) 6% per inch (C) 1.2% per inch (D) 1% per inch (E) 1.5% per inch (F) 2% per inch

9. The area of the block for 72 to 77 inches (inclusive) represents:

(A) measurement (B) height categories (C) number of women
(D) percent of women per inch (E) percent of women

10. The area of the block for 72 to 77 inches (inclusive) is:

(A) 1 woman (B) 1 inch (C) 1% (D) 6% (E) 1.2% per inch

11. A list has 6 entries: 3, 6, 10, 10, 12, and 19. Find the value in standard units of the smallest number on that list.

    (A) -7 (B) -1.8 (C) -1.4 (D) -0.28 (E) 1

12. A list has 6 entries: 3, 6, 10, 10, 12, and 19. List all numbers on the list that are within 1.5 SDs of the average.

    (A) 10 and 10 (B) 6, 10, 10, and 12 (C) 3, 6, and 12 (D) all but 19 (E) all of them

For problems 13 to 17

The average height for a group of men was 68 inches and the SD was 3.6 inches. The data followed the normal curve.

13. One man's height was 1.361 SDs below average. In standard units, his height is:

    (A) -4.8996 (B) -1.361 (C) -0.378 (D) 1.361 (E) 2

14. Using the normal curve, an estimate for the percent of men with heights between 66.5 and 71 inches is:

    (A) 15% (B) 21% (C) 29% (D) 46% (E) 92%

15. A man who was 62 inches tall, was at what percentile of the height distribution?

    (A) 5th (B) 10th (C) 55th (D) 90th (E) 95th

16. To be at the 74th percentile of the distribution, how tall did a man need to be?

    (A) 68.74 inches (B) 69.08 inches (C) 69.17 inches (D) 70.34 inches (E) 72.05 inches

17. What percent of the men in the distribution are taller than a man who was at the 88th percentile?

    (A) 6% (B) 12% (C) 38% (D) 88% (E) 94%

18.

x	y
1	1
3	7
4	3
5	4
7	5

The correlation coefficient, r, for the above data set is:

(A) -0.575 (B) -0.275 (C) 0.45 (D) 0.625 (E) 0.90

For problems 19, 20, 21, 22, and 23

A group of men in a survey produced the following data:

average height = 70 inches, SD = 3 inches
average weight = 180 pounds, SD = 45 pounds, $r = 0.4$

19. A man picked at random from the above group is 72-inches tall. Predict his weight.

    (A) 180 pounds (B) 192 pounds (C) 194.4 pounds (D) 210 pounds (E) 216 pounds

20. A man who is at the 91st percentile of heights is likely to be at what percentile of weights?

    (A) 60th (B) 66th (C) 71st (D) 75th (E) 91st

21. If a individual who was picked at random and weighed 200 pounds were to eat more and gain 30 pounds, how many inches taller would he be.

    (A) 0 inches (B) .64 inches (C) .96 inches (D) 1.92 inches (E) 2 inches

22. Find the root-mean-square error of the regression line for predicting weight from height.

    (A) 18 pounds (B) 27.982 pounds (C) 39.477 pounds (D) 41.243 pounds (E) 45 pounds

23. Find the regression equation for predicting weight from height.

    (A) $y = 0.02667x + 65.2$ (B) $y = 0.0667x + 58$ (C) $y = 0.0667x + 175.331$
    (D) $y = 6x - 240$ (E) $y = 6x + 240$ (F) $y = 15x - 870$

For Problems 24 and 25:

Three cards will be drawn at random without replacement from a standard deck of cards.

A standard deck has 52 cards: 12 picture cards and 40 others.

24. Find the chance that at least one of three cards drawn will be a picture card. (No replacement.)

    (A) 1% (B) 45% (C) 55% (D) 69% (E) 99%

25. Find the chance that not all 3 of the cards drawn turn out to be picture cards. (No replacement.)

    (A) 1% (B) 45% (C) 55% (D) 69% (E) 99%

For Problems 26 and 27:

Three cards will be drawn at random with replacement from a standard deck of cards.

A standard deck has 52 cards: 20 even-numbered cards and 32 others.

26. Find the chance that not all the cards drawn will be even-numbered.

    (A) 5.7% (B) 23.3% (C) 76.7% (D) 94.3% (E) 97.1%

27. Find the chance that every one of the cards drawn will not be even-numbered (none of the cards will be even-numbered).

    (A) 5.7% (B) 23.3% (C) 76.7% (D) 94.3% (E) 97.1%

For Problems 28 and 29:

The chance that my commuter train will be on time on any given day is 93%, and the results are independent.

28. The chance that the train will be late at least once in any 7 commuting days is:

    (A) 7% (B) 32% (C) 40% (D) 49% (E) 60%

29. The chance that the train will be late exactly once in any 7 commuting days is:

    (A) 7% (B) 32% (C) 40% (D) 49% (E) 60%

30. A player tosses a fair coin and will win $100 if the number of heads turns out to be 5 or less away from the expected number of heads.

Which is better 100 tosses or 10,000 tosses? Explain.

(A) 100 tosses. The SE for the sum of the draws needs to be large.

(B) 100 tosses. It is better for him if the SE for the sum of the draws is small.

(C) 1,000 tosses. It is best when the standard error for the sum of the draws is smaller.

(D) 1,000 tosses. It is best when the standard error for the sum of the draws is larger.

(E) Both options are about the same.

31. A player tosses a fair coin and will win $100 if the percentage of heads turns out to be between 55% and 60%.

Which is better 100 tosses or 1,000 tosses? Explain.

(A) 100 tosses. It is better when the standard error for the percentage tends to be small.

(B) 100 tosses. It is better when the standard error for the percentage tends to be larger.

(C) 1,000 tosses. It is better when the standard error for the percentage tends to be smaller.

(D) 1,000 tosses. It is better when the standard error for the percentage tends to be larger.

(E) Both options are about the same.

32. A fair coin is tossed 30 times. Find, to the nearest percent, the chance of getting exactly 19 heads.

(A) 1% (B) 3% (C) 5% (D) 8% (E) 10%

33. A fair die is rolled 20 times. Find, to the nearest 0.01 percent, the chance of getting exactly 6 threes.

(A) less than 0.01% (B) 1.13% (C) 2.977% (D) 4% (E) 6.47%

34. A fair coin is tossed 125 times. Estimate the chance of getting exactly 72 heads.

(A) 1.585% (B) 1.885% (C) 3.17% (D) 3.77% (E) 4.455%

35. A box contains 32 tickets, numbered 1 through 32. One hundred and seventy-nine (179) draws are made at random with replacement from that box.

The percentage of 7's drawn should end up around 3.125%, give or take:

(A) 0.097% (B) 0.13% (C) 0.2263% (D) 0.2336% (E) 1.3% (F) 3.464%

36. A simple random sample of 7,000 registered voters is taken to estimate the percentage of Republicans in Massachusetts. It turns out that 651 of the people in the sample are Republicans. A 95%-confidence interval for the percentage in the entire state is:

(A) 8.606 to 9.994% (B) 8.953 to 9.647% (C) 8.967 to 9.633% (D) 9.078 to 9.522% (E) 9.2 to 9.4%

37. A simple random sample of 4,000 households from the 3,250,00 households in New York City was taken. In the sample, the average household income was $105,148, with an SD of $39,400.

The $105,148 is off the average income in the entire city by about:

(A) $10 (B) $22 (C) $623 (D) $1662.54 (E) $39,400 (F) 3.8%

38. A box contains a large number of tickets. The numbers on these tickets average out to 100, and the SD is 5.

Thirty-six tickets are drawn at random with replacement.

Find the chance that the average of the draws will be in the range 97 to 103.

(A) 1.33% (B) 7.97% (C) 45.15% (D) 98.76% (E) 99.73% (F) 99.968%

39. A simple random sample of 1,600 tickets was taken from a box with a large number of tickets. The average of the box is unknown. The sample averaged 209, with an SD of 2.

Find a 95%-confidence interval for the average of the box.

(A) 208.9975 to 209.0025 (B) 208.95 to 209.05 (C) 208.9 to 209.1 (D) 207 to 211 (E) 205 to 213

40. A truck is to be weighed on a truck scale. Each time it is weighed, the reading is off from the actual weight of the truck by some error.

The truck is to be driven off the scale, returned to the scale, and weighed again. This process is repeated a number of times.

For the Gauss model to apply here, which of the following assumptions must be made?

Assumptions

a. The errors come from an error box; the box is the same for each weighing.

b. The errors are drawn from the box at random.

c. The average of the error box is 0.

d. There are a large number of draws.

e. The tickets in the error box are normally distributed.

(A) a through d (B) a through c (C) a through c, and e (D) all of them (E) a and c only

41. A truck is to be weighed on a truck scale. Each time it is weighed, the reading is off from the actual weight of the truck by some error.

The truck is to be driven off the scale, returned to the scale, and weighed again. This process is repeated a number of times.

For a confidence interval based on the Gauss model to apply here, which of the following assumptions must be made?

Assumptions

a. The errors come from an error box; the box is the same for each weighing.

b. The errors are drawn from the box at random.

c. The average of the error box is 0.

d. There are a large number of draws.

e. The tickets in the error box are normally distributed.

f. The SD of the errors must have been known in advance.

(A) a through d (B) a through c (C) a through d, and e (D) all of them (E) a through d, and f

For Problems 42 to 44

A truck is weighed 130 times on a truck scale. The 130 readings average 12,347 pounds, and the SD of the 130 readings is 17 pounds. (Assume the Gauss model.)

42. Weighings should be off from the actual weight of the truck by an amount estimated as:

(A) 1.49 pounds (B) 2.98 pounds (C) 17 pounds (D) 193.83 pounds (E) 2,210 pounds

43. The actual weight of the truck is off from 12,347 pounds by about how much?

(A) 1.49 pounds (B) 2.98 pounds (C) 17 pounds (D) 193.83 pounds (E) 2,210 pounds

44. Find, if possible, a 95%-confidence interval for the weight of the truck in pounds.

(A) 12,330 to 12,364 (B) 12,345.51 to 12,348.49 (C) 12,344.02 to 12,349.98
(D) 12,313 to 12,381 (E) 12,346.74 to 12,347.26 (F) a confidence interval is not possible

45. A coin was tossed 34 times and got 22 heads.

Set up an appropriate test of hypotheses. Then find P and decide if the coin is fair or gets too many heads.

(The histogram has large blocks; apply the continuity correction ($\pm 1/2$) to any endpoints used.)

(A) $P = 3.185\%$, not fair (B) $P = 4.555\%$, not fair (C) $P = 6.055\%$, fair
(D) $P = 8.91\%$, fair (E) $P = 12.11\%$, fair

46. A die was rolled 90 times and got 22 fives.

Set up an appropriate test of hypotheses. Then find P and decide if the die is fair or gets too many fives.

(The histogram has large blocks; apply the continuity correction ($\pm 1/2$) to any endpoints used.)

(A) $P = 3.215\%$, not fair (B) $P = 4.455\%$, not fair (C) $P = 6.055\%$, fair
(D) $P = 8.91\%$, fair (E) $P = 12.11\%$, fair (F) 1.43%, not fair

47. A gambler is accused of using a loaded die, but he pleads innocent. A record has been kept of the last 120 throws. There is disagreement about how to interpret the data and a statistician is called in.

The observed frequencies for the six numbers on the die are summarized in this table.

Value	*Observed frequency*
1	15
2	27
3	21
4	17
5	11
6	29

A χ^2-test of the null hypothesis that the die is fair was made. State P and the conclusion.

(A) 1%, unfair (B) 4%, unfair (C) $5\frac{1}{2}$%, fair (D) 12%, fair (E) 30%, fair

48. For each of the following statements, decide if it is true or false.

(a) The height of a block in a histogram is the percentage of the population in the inteval of the block.
(b) When the categories for a histogram are counting numbers, the block for a single value should have a base one wide, centered on that number.
(c) A typical number on a list will be off from the average of the list by an amount on the order of the SD.
(d) The standard units for a value is the number of SDs it is above or below the average.
(e) A simple random sample is drawn at random with replacement.
(f) When a large random sample is taken from a large population, the sample average will be off from the population average by the SD of the box.
(g) The more you toss a fair coin, the closer the observed percentage of heads gets to 50%.
(h) With a well-designed survey, the sample percentage is very likely to equal the population percentage.
(i) If the data don't follow the normal curve, you can't use the curve to get confidence intervals.

49. A researcher wanted to estimate the percentage of citizens who supported the new constituion in the Arab Republic of Egypt. He took a simple random sample of 625 citizens and surveyed them. This led to an estimate and a confidence interval for the support in the whole country.

A crotchety old man took issue with the whole process, saying: "How can you tell me anything about the whole country? You have only *one* sample of size 625. For me that is not enough. You are engaged in mathematical trickery and sophistry. We know nothing about the country as a whole."

Write a very short essay, responding to the statements of the old man, using the principles of the course and the ideas of the text. A correct response could have as little as two sentences. Be brief.