AP Statistics Practice Examination 4

Multiple Choice
Statistics
Section I

Time: 90 minutes

1. Which of the following statements is (are) correct?

   I. Correlation makes no distinction between explanatory and response variables.
   II. The sign of r reflects the strength of the association.
   III. r measures the strength of a *linear* relationship only.

   (A) I only
   (B) II only
   (C) III only
   (D) I and II
   (E) I and III

2. In a random sample of 500 women, 120 are college graduates. With what confidence can we assert that between 22% and 26% of women are college graduates?

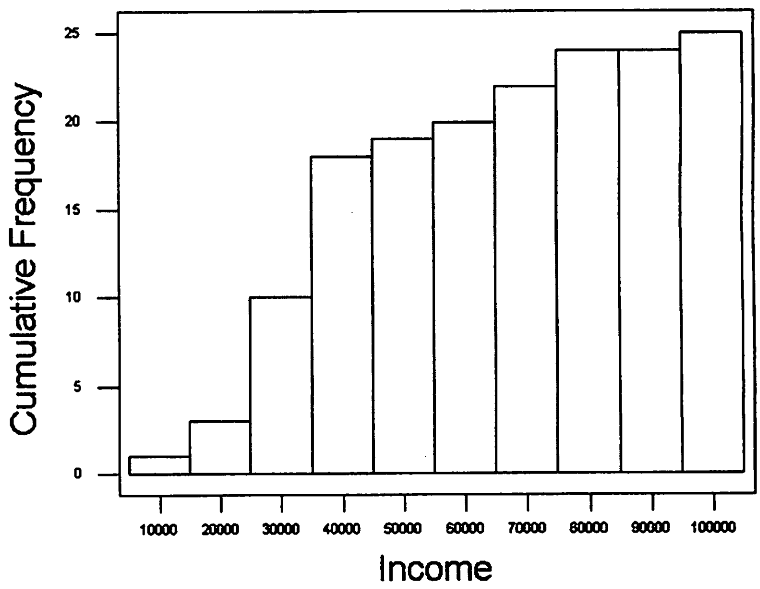
   (A) 2%
   (B) 4%
   (C) 14.75%
   (D) 24%
   (E) 70.49%

3. The median of a distribution is 150 and the interquartile range is 50. Identify the statement(s) that *must* be true.

   I. 50% of the data are between 125 and 175.
   II. 50% of the data are less than or equal to 150.
   III. 75% of the data are greater than 125.

   (A) I only
   (B) II only
   (C) I and II only
   (D) II and III only
   (E) I, II, and III

4. Twenty-five men were polled, and their annual incomes were recorded. The cumulative frequency histogram below shows the results.



Which of the following statements can be made upon examination of the histogram?

(A) The same number of men had incomes between \$75,000 and \$85,000 as between \$85,000 and \$95,000.
(B) The median income was \$55,000.
(C) The mean income was less than the median income.
(D) The modal income was between \$35,000 and \$45,000.
(E) No men had incomes between \$75,000 and \$85,000.

5. Only 6 out of every 100 people have blood type O^+. What is the probability that in a random sample of individuals, the first person with type O^+ blood will be the eighth person tested?
   (A) $C(8, 8)(0.06)^8(0.94)^0$
   (B) $C(8, 1)(0.06)^1(0.94)^7$
   (C) $C(1, 8)(0.06)^1(0.94)^7$
   (D) $(0.06)^1(0.94)^7$
   (E) $(0.06)^7(0.94)^1$

6. Mr. DeVeaux teaches two sections of AP* Physics. He has 38 seniors in one section and 24 juniors in the other section. The overall mean for both sections on the midterm exam was 87. If the junior section had a mean of 92, what was the approximate mean for the senior section on the midterm exam?
   (A) 82.6
   (B) 83.8
   (C) 89.5
   (D) 87.0
   (E) 90.4

7. Which of the following is/are acceptable ways to express your decision at the end of a hypothesis test?

   I. Fail to reject H_0; accept H_a
   II. Accept H_0; reject H_a
   III. Reject H_0; accept H_a

   (A) I only
   (B) II only
   (C) III only
   (D) All are acceptable.
   (E) None are acceptable.

8. The following table gives the percentage of nursing home residents by age.

Age	under 65	65–74	75–84	85 and older
Percentage	9.8	12	31.8	46.5

In a random sample of 150 families with a relative in a nursing home, the following was the distribution of the relatives' ages: 10 under 65, 20 ages 65–74, 52 ages 75–84, and 68 ages 85 and older. If a goodness-of-fit test were performed, what would be the value of the χ^2 statistic?

(A) 0.541
(B) 0.707
(C) 2.156
(D) 2.810
(E) 28.110

9. If $P(A) = 0.7$, $P(not\ B) = 0.4$, and $P(A \text{ and } B) = 0.5$, find $P(A \text{ or } B)$.

(A) 1.3
(B) 0.6
(C) 0.8
(D) 0.1
(E) 1.1

10. If you wanted to find the average GPA for seniors at your school who have been accepted into college, what would be the most appropriate technique to use to gather the data?

(A) Census
(B) Simple random sample
(C) Stratified random sample
(D) Systematic random sample
(E) Controlled experiment

11. Given that a population has a standard deviation of 0, which of the following statements *must* be true?

    I. The standard deviation of a sample drawn from the population is also 0.
    II. The sample mean of a sample drawn from the population is also 0.
    III. The sample mean and median are equal for a sample drawn from the population.

    (A) I only
    (B) III only
    (C) I and II only
    (D) I and III only
    (E) I, II, and III

12. A meteorologist wants to simulate 20 days of weather in a region where the probability of precipitation during the season being simulated is 40%. She uses a random-number table as shown.

    23091 05892 21007 43902 62973 29940 69630 91312

    If *R* represents a rainy day and *N* represents a day without rain, which of the following could be the meteorologist's simulation result?

(A)	*NRNRR*	*RNRNR*	*NRNNR*	*NRRNN*	10 of the 20 days will be rainy.
(B)	*RRRNN*	*RRNRR*	*NNRNR*	*NNRRR*	12 of the 20 days will be rainy.
(C)	*RRRNR*	*RNNNR*	*RRRRN*	*NRNRR*	13 of the 20 days will be rainy.
(D)	*RRRNR*	*RNNNR*	*RRRRN*	*RRNRR*	14 of the 20 days will be rainy.

    (E) There is an insufficient number of random digits to conduct this simulation.

13. The American judicial system is based on the assumption that a person is innocent until proved guilty. A defendant is accused of a crime. What is the consequence of a Type II error?

    (A) The jury finds the defendant innocent; he is innocent.
    (B) The jury finds the defendant innocent; he is guilty.
    (C) The jury finds the defendant guilty; he is innocent.
    (D) The jury finds the defendant guilty; he is guilty.
    (E) The jury declares a mistrial because an error has been made.

14. A random sample of 27 individuals is selected, and the age and income of each individual is recorded. Regression analysis is performed, with the following results.

```
Dependent variable is:    Income
No Selector
R squared = 2.0%     R squared (adjusted) = -1.9%
s =  2.734e4  with  27 - 2 = 25  degrees of freedom
```

Source	Sum of Squares	df	Mean Square	F-ratio
Regression	3.90728e8	1	3.90728e8	0.523
Residual	1.86828e10	25	7.4731e8	

Variable	Coefficient	s.e. of Coeff	t-ratio	prob
Constant	27300.4	1.576e4	1.73	0.0956
Age	244.203	337.7	0.723	0.4763

Is there a significant relationship between age and income?

(A) A significant relationship exists between age and income at the $\alpha = 0.10$ level but not at the $\alpha = 0.05$ level.

(B) A significant relationship exists between age and income at the $\alpha = 0.05$ level but not at the $\alpha = 0.01$ level.

(C) A significant relationship exists between age and income at the $\alpha = 0.01$ level but not at the $\alpha = 0.001$ level.

(D) A significant relationship exists between age and income at the $\alpha = 0.001$ level.

(E) A significant relationship between age and income does not exist at any of the commonly accepted levels.

15. Suppose that 25% of horses live over 23.4 years, while 85% live less than 25.2 years. Assuming the ages of horses are normally distributed, what are the mean and standard deviation for the life expectancy of horses?

(A) mean 20.14; standard deviation 4.86

(B) mean 22.690; standard deviation 1.052

(C) mean 22.690; standard deviation 4.97

(D) mean 24.110; standard deviation 1.052

(E) Not enough information is given to find the mean and standard deviation.

16. Statistics show that 7.3% of workers between the ages of 16 and 24 earn the minimum wage or less. What is the probability that if three young adults between the ages of 16 and 24 are polled, two or more will earn the minimum wage or less?

(A) 0.0004

(B) 0.0148

(C) 0.0152

(D) 0.0627

(E) 0.0677

17. To work in the word-processing department at Dewey, Cheatem, and Howe, a large center-city law firm, you must be able to type at least 80 words per minute. The director of the human resources department is revising the job description for word processors. She believes that it is possible to adjust the typing speed upward and still have a sufficient number of qualified candidates. She takes a random sample of 15 employees from the word-processing department and gives them a typing test. The mean typing speed is 93 words per minute with a standard deviation of 7 words per minute. Assume that typing speeds follow an approximately normal distribution. A 98% confidence interval for the mean number of words typed by word processors at this law firm is (88.26, 97.74). What is the t^* critical value used to compute this interval?

(A) 2.131

(B) 2.145

(C) 2.249

(D) 2.264

(E) 2.624

18. Two random samples from two independent populations are taken with the following results.

Sample 1	Sample 2
$n = 30$	$n = 40$
$\bar{x} = 26$	$\bar{x} = 31$
$s = 3.2$	$s = 3.8$

The standard error of the sampling distribution of the differences of the means is

(A) 0.594

(B) 0.838

(C) 4.968

(D) 7.000

(E) 24.646

19. Of the registered voters in a community, 58% are female. A local politician running for office has the support of 48% of the registered women and 53% of the registered men. What percentage of the vote can the politician expect to get?

(A) 49.8%

(B) 50.1%

(C) 50.5%

(D) 58.58%

(E) Not enough information is given to determine the percentage of support for the politician.

20. The percentages of children living below poverty levels for white and Asian children in the United States from 1987 to 2000 are given in the back-to-back stemplot.

White		Asian
	10	
	11	8
9	12	
5	13	
8 5	14	4
9 3 1	15	
9 8 3 2 1	16	4
8 4	17	5 6
	18	0 2 3
	19	5 5 8
	20	3
	21	
	22	
	23	5
	24	1

11 | 8 = 11.8%

Which of the following is a statement that can be made from an examination of the back-to-back stemplot?

(A) For every year from 1987 to 2000, the percentage of white children living in poverty is lower than the percentage of Asian children.

(B) If the outliers are removed from the distribution of Asian poverty-level percentages, the range for the distribution of white children will be larger than that for Asian children.

(C) The mean poverty-level percentage for both white and Asian children is less than the respective median value.

(D) The poverty-level percentages for both white and Asian children have increased over time.

(E) There is more variability in the poverty-level percentages for Asian children than for white children.

21. Which of the statements listed below is correct?

    I. The slope of a regression line can be calculated from the formula $b = \frac{r \cdot s_y}{s_x}$.

    II. Residual = actual value − fitted value

    III. Causation is demonstrated by the correlation coefficient.

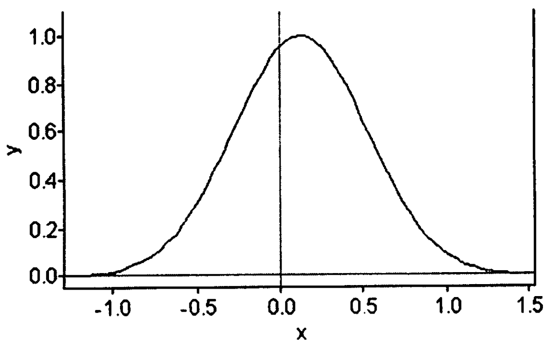
    (A) I only
    (B) II only
    (C) III only
    (D) I and II only
    (E) II and III only

22. A set of numbers contains five values. The largest value is 500, and the range is 100. Which of the following statements is *not* true?

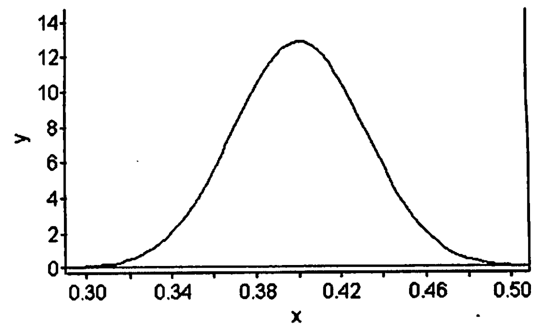
    (A) The largest possible value for the mean is 480.
    (B) The smallest possible value for the mean is 420.
    (C) The largest possible value for the median is 500.
    (D) The smallest possible value for the median is 400.
    (E) The smallest possible value for the standard deviation is 0.

23. Which of the following could represent the sampling distribution of sample proportions if $p = 0.40$ and $n = 16$?

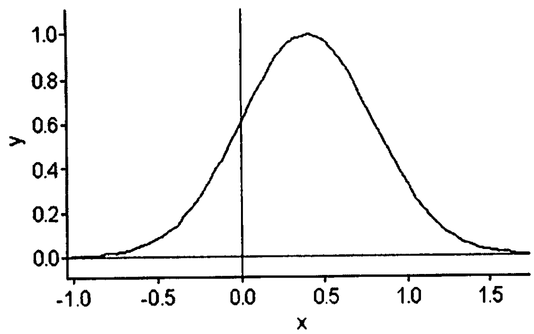
(A)



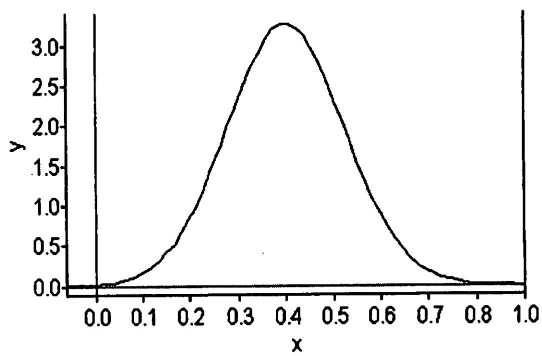
(B)



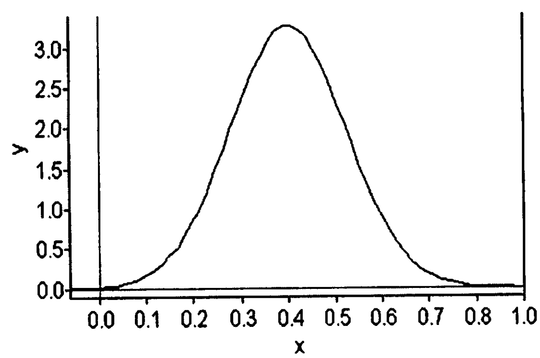
(C)



(D)



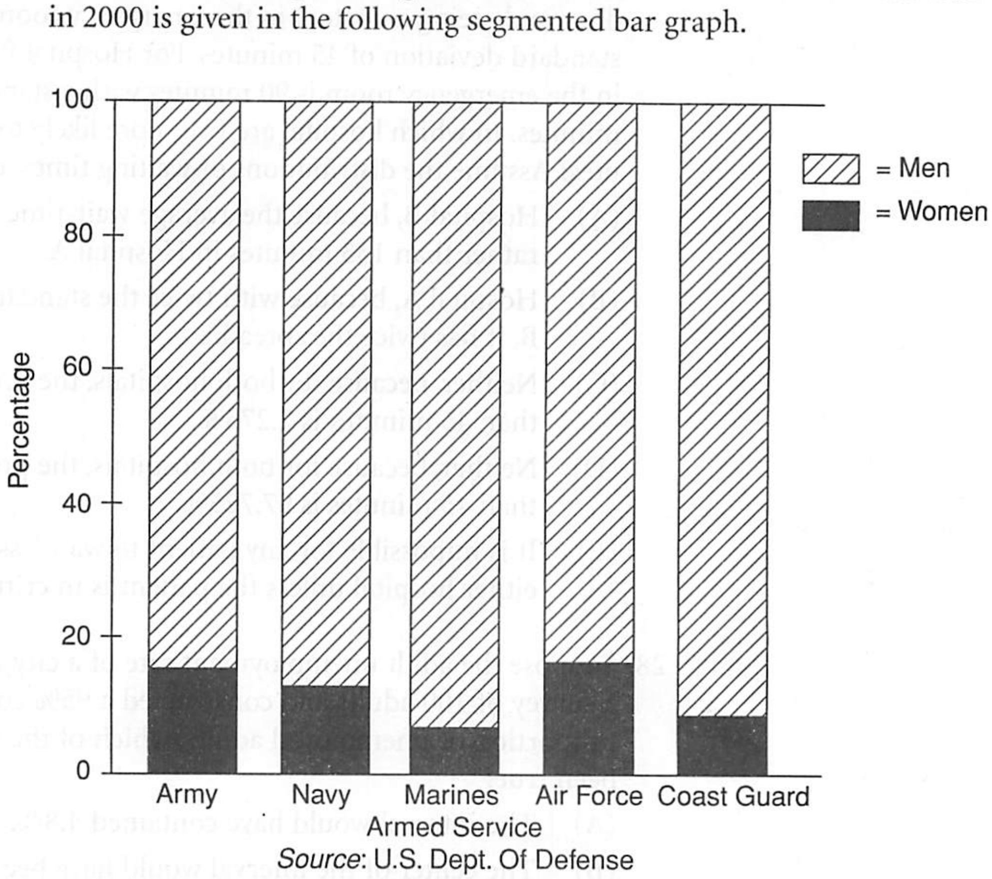
(E)



24. A population is normally distributed with mean 42.3 and standard deviation 2.8. The variance for the sampling distribution of sample means for samples of size 10 is

(A) 0.028
(B) 0.280
(C) 0.784
(D) 0.885
(E) 2.479

25. The breakdown of percentages of men and women in the armed services in 2000 is given in the following segmented bar graph.



Which of the following can be stated from an observation of the chart?

(A) The number of women in the Marines is less than the number of women in any other armed service.

(B) The number of men in the Air Force is less than the number of men in any other armed service.

(C) The percentage of women in the Marines is less than the percentage of women in any other armed service.

(D) The proportion of men in each of the services is the same.

(E) The percentage of women in the armed services is changing over time.

26. If $P(B) = 0.4$ and $P(A \cap B) = 0.21$, then find $P(A)$ if A and B are independent.

(A) 0.084

(B) 0.475

(C) 0.525

(D) 0.600

(E) Not possible

27. For Hospital A, the average waiting time (time between walking in the door and seeing a doctor) in the emergency room is 135 minutes with a standard deviation of 45 minutes. For Hospital B, the average waiting time in the emergency room is 90 minutes with a standard deviation of 22.5 minutes. In which hospital are you more likely to wait less than 45 minutes? Assume the distributions of waiting times are normally distributed.
    (A) Hospital B, because the average wait-time is only 90 minutes, rather than 135 minutes in Hospital A.
    (B) Hospital A, because with twice the standard deviation of Hospital B, it has twice the spread.
    (C) Neither, because for both hospitals, the probability of waiting less than 45 minutes is 2.275%.
    (D) Neither, because for both hospitals, the probability of waiting less than 45 minutes is 97.725%.
    (E) It is impossible for any patient to wait less than 45 minutes in either hospital unless the patient is in critical condition.

28. Suppose the adult unemployment rate of a city is 4.8%. If you had taken a survey of 100 adults and constructed a 95% confidence interval for the proportion of unemployed adults, which of the following would have been true?
    (A) The interval would have contained 4.8%.
    (B) The center of the interval would have been 4.8%.
    (C) You would have had a 95% probability that the interval contained 4.8%.
    (D) Increasing the sample size would have ensured capturing 4.8%.
    (E) Approximately 95% of similarly constructed intervals would have captured 4.8%.

29. A recent news program reported that the presidential approval rate was 51% with a margin of error of ±4%.

    What is meant by ±4%?
    (A) 4% of the respondents were undecided.
    (B) The proportion of Americans who approve of the president is between 49% and 53%.
    (C) The president's approval rating from those sampled was between 47% and 55%.
    (D) The proportion of Americans who approve of the president is between 47% and 55%.
    (E) Unless the true proportion of Americans who approve of the president is between 47% and 55%, it is unlikely we could have obtained these sample results.

30. An aspirin maker claims that 4 out of 5 doctors recommend its product. A consumer advocacy group believes the proportion is lower. To test the claim, a random sample of 50 doctors is selected, and 35 recommend this manufacturer's product. An appropriate test outcome is

(A) $z = -1.768$ and $p = 0.039$

(B) $z = -1.768$ and $p = 0.077$

(C) $z = -1.768$ and $p = 0.961$

(D) $t = -1.768$ and $p = 0.042$

(E) $t = -1.758$ and $p = 0.083$

31. Ruth plans to sell the jewelry she makes at an outdoor craft festival this coming Saturday. Based on her experience from past years, she can expect to make a profit of \$400 if it is a sunny day, \$275 if the weather is overcast, and \$100 if it is raining. The weather forecaster (based on historical records) has estimated the chance of a sunny day for the day of the craft festival to be 0.65, the chance of an overcast day to be 0.15, and the chance of a rainy day to be 0.20. What is Ruth's expected profit from the sale of her jewelry?

(A) \$400.00

(B) \$321.25

(C) \$275.00

(D) \$258.33

(E) \$100.00

32. Suppose we have a random variable X with probability p. The probability of exactly 3 successes in 8 trials is given by

$$P(X = 3) = C\binom{8}{3}(p)^3(0.45)^5.$$

What is the mean and standard deviation of X?

(A) mean = 4.4; standard deviation = 0.2475

(B) mean = 3.6; standard deviation = 0.2475

(C) mean = 4.4; standard deviation = 1.4071

(D) mean = 3.6; standard deviation = 1.4071

(E) There is not enough information to find the mean and standard deviation.

33. A regression equation is given as $\log \hat{y} = 0.214 - 1.28x$. What is the (approximate) predicted value for y when $x = 2$?
(A) -2.346
(B) -0.171
(C) 0.005
(D) 0.167
(E) Cannot be determined

34. We are given two sample proportions, $\hat{p}_1 = 0.38$ and $\hat{p}_2 = 0.42$. A 90% confidence interval for the true difference in population proportions if $n_1 = 40$ and $n_2 = 50$ is
(A) $-0.04 \pm 1.645\sqrt{\frac{(0.38)(0.62)}{40} + \frac{(0.42)(0.58)}{50}}$
(B) $0.04 \pm 1.697\sqrt{\frac{(0.38)(0.62)}{40} + \frac{(0.42)(0.58)}{50}}$
(C) $-0.04 \pm 1.729\sqrt{\frac{(0.38)(0.62)}{40} + \frac{(0.42)(0.58)}{50}}$
(D) $0.04 \pm 1.96\sqrt{\frac{(0.38)(0.62)}{40} + \frac{(0.42)(0.58)}{50}}$
(E) not able to be constructed.

35. The residuals for a complete data set are shown below, and r^2 for the least squares regression line that resulted in these residuals is 88.6%.

x	25	30	35	40	45	50	55	60	65	70
Residual	0	1.2	2.0	0.97	0.9	−1.1	−4.6	−0.6	0.25	0.98

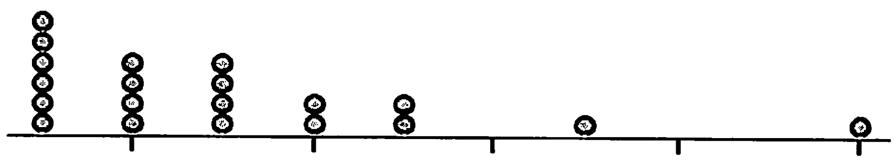
Which of the following is/are true?

I. The linear model is a good model for the data.
II. The sum of the squares of the residuals is zero.
III. The correlation is either $\pm\sqrt{0.886}$.

(A) I only
(B) II only
(C) III only
(D) I and III only
(E) I, II, and III

36. Two students went to their local shopping mall to conduct a survey. They wanted to know how the local population felt about boys coloring their hair. Both students had neat haircuts but one had dyed hair and one did not. What type of bias could occur in their survey?
    (A) Undercoverage
    (B) Nonresponse bias
    (C) Response bias
    (D) None of the above
    (E) A, B, and C may produce bias in this setting.

37. For the dotplot shown, which of the statistical values listed would be least affected by the rightmost value?



    (A) Standard deviation
    (B) Range
    (C) Variance
    (D) Mean
    (E) Median

38. A χ^2-distribution with 14 degrees of freedom is a correct model for
    (A) a comparison of the production percentage distribution of 7 car model colors with the statistically determined national preferences for those colors.
    (B) testing the question of whether 14 genetic traits are equally distributed in a population.
    (C) testing whether choice of color is independent of age among 3 age groups and 5 color choices.
    (D) testing whether the choice to smoke cigarettes or not to smoke cigarettes is independent of ethnicity among 7 different ethnic groups.
    (E) a comparison of the equality of proportions of 8 sports activities for 3 high school grade levels.

39. Starting time for hourly wage employees at a large manufacturing plant is 7 A.M. If an employee clocks in before 7:15 A.M., he is not marked as being late for work and his pay is not reduced. A random sample of 15 daily time sheets from the past two years showed that the average number of employees who arrived at work between 7 A.M. and 7:15 A.M. each day was 23 with a standard deviation of 6. Assume that the assumptions for inference have been met. Construct a 90% confidence interval for the mean number of employees who arrive at work during this time frame each day.

(A) 23 ± 2.728
(B) 23 ± 3.315
(C) 23 ± 2.630
(D) 23 ± 3.301
(E) 23 ± 2.894

40. For the given probability distribution, find the standard deviation of X.

X	1	3	5	7	9
$P(x)$	0.13	0.17	0.25	0.24	0.21

(A) 0.050
(B) 2.621
(C) 3.162
(D) 5.460
(E) 6.868

Part B

Suggested time: 25 minutes

6. A store that sells cellular telephones opened for business twelve years ago. Total sales of cellular telephones for each year of business are given.

Year	1	2	3	4	5	6	7	8	9	10	11	12
Units Sold	375	566	671	1106	1311	1283	2136	2967	4094	4572	5157	6621

a. Record and interpret the slope of the least squares regression line that describes the relationship between the number of cellular telephones sold and the business year.

b. Record and interpret the value of the correlation coefficient for the year of business and the number of cell phones sold.

c. Use this model to predict the number of cell phones the store will sell in the next business year.

d. Describe any shortcomings you see in this model.

e. Find a better model for predicting the number of units sold for a given business year. Justify your choice, and use three decimal places for your slope and intercept coefficients.

f. Use your model from part (e) to predict the number of cell phones the store will sell in the next business year.

ANSWERS AND EXPLANATIONS

Practice Examination 4

Section I: Multiple Choice Solutions

1. E
   The sign of r indicates the *direction* of the association, not the *strength.*
2. E
   For this problem, the margin of error is 0.02, and the sample proportion is 0.24. Thus, the following equation can be used to solve for z^*:

   $$0.02 = z^*\sqrt{\frac{(0.24)(1 - 0.24)}{500}},$$

   and $z^* = 1.047$. To find the level of confidence, we find

   $P(-1.047 < z < 1.047) \approx 0.7049.$

3. B
   The IQR tells us the distance between Q1 and Q3. It does not tell us how that distance is distributed about the median.
4. D
   There were eight men with incomes between \$35,000 and \$45,000, higher than any other income interval. Remember that this is a *cumulative frequency* histogram.
5. D
   We are looking for the geometric probability of a first success on a particular trial where $p = 0.06$ and $q = 0.94$. The formula is $P(X = x) = q^{1-x}p$ or $P(X = 8) = (0.94)^7(0.06)$. Picture a tree diagram where you make eight selections of individuals with the first seven being "failures" with probability 0.94 (having a blood type other that O^+) and the last being a "success" with probability 0.06.
6. B

   $$\bar{x}_{\text{juniors}} = \frac{\sum x_{\text{juniors}}}{n_{\text{juniors}}};\ 92 = \frac{\sum x_{\text{juniors}}}{24};\ \sum x_{\text{juniors}} = 2208$$

   $$\bar{x}_{total} = \frac{\sum x_{\text{total}}}{n_{\text{total}}};\ 87 = \frac{\sum x_{\text{total}}}{62};\ \sum x_{\text{total}} = 5394$$

   $$\sum x_{\text{seniors}} = \sum x_{\text{total}} - \sum x_{\text{juniors}} = 5394 - 2208 = 3186$$

   $$\bar{x}_{\text{seniors}} = \frac{\sum x_{\text{seniors}}}{n_{\text{seniors}}};\ \bar{x}_{\text{seniors}} = \frac{3186}{38}$$

   $$\approx 83.8$$

7. C

Your decision must always be stated in terms of *rejecting* or *failing to reject* the null hypothesis. If you *reject* the null hypothesis, you are in favor of (accepting) the alternative hypothesis. If you *fail to reject* the null hypothesis, you do NOT accept the alternative hypothesis. (Remember, this statement is part of a fuller statement that includes your reason and the context of the problem.)

8. C

First, the expected counts should be computed.

Age	under 65	65–74	75–84	85 and older
Percentage	14.7	18	47.7	69.75

$$\chi^2 = \sum \frac{(Obs - Exp)^2}{Exp}$$

$$= \frac{(10 - 14.7)^2}{14.7} + \frac{(20 - 18)^2}{18}$$

$$+ \frac{(52 - 47.7)^2}{47.7} + \frac{(68 - 69.75)^2}{69.75} \approx 2.156$$

9. C

$P(B) = 1 - P(not\, B) = 1 - 0.4 = 0.6;$

$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$

$= 0.7 + 0.6 - 0.5 = 0.8.$

10. A

Since it is possible in a relatively easy manner to find the GPA for *every* senior who has been accepted to college, a census is the most appropriate technique.

11. D

If the population has a standard deviation of 0, then all values in the population are identical. These values may or may not be 0. Since all of the values are identical, if a sample is drawn from the population, the sample will consist of identical values. Therefore, the standard deviation of the sample is 0, and the mean and median are equal for the sample.

12. C

Answer choice C assigns 0–3 to represent rain (R) and 4–9 to represent no rain (N). If you use a two-digit representation, 00–39 would be rain (R) and 40–99 would be no rain (N). Answer choice B incorrectly assigns both 00 and 40 for rain. Answer choice A uses evens and odds; this would simulate 50%. Answer choice D uses 0–4 to represent rain; this would simulate 50%. Answer choice E incorrectly assumes you must use three digits to simulate percentages so that 100% can be represented.

13. B
A Type II Error is committed when we fail to reject the null hypothesis when the alternative hypothesis is true.

14. E
The null hypothesis would be that there is no relationship between age and income. The alternative hypothesis would be that there is a relationship between age and income. The p-value for the slope can be found in the last row of output corresponding with the explanatory variable age.

Variable	Coefficient	s.e. of Coeff	t-ratio	prob
Constant	27300.4	1.576e4	1.73	0.0956
Age	244.203	337.7	0.723	0.4763

With a p-value of 0.4763, we do not have sufficient evidence at any of the commonly accepted levels to show a relationship between age and income.

15. A
If 25% of horses live over 23.4 years, then 75% of horses live under 23.4 years. From the standard normal table, the z-score associated with 0.75 is 0.67. The z-score associated with 85% living less than 25.2 years is 1.04. Using the formula for standardized scores,

$$0.67 = \frac{23.4 - \mu}{\sigma} \text{ and } 1.04 = \frac{25.2 - \mu}{\sigma}.$$

Solving algebraically gives $\mu = 20.14$ and $\sigma = 4.86$.

16. C
This is a binomial setting with $n = 3$ and $p = 0.073$. We are asked to find the probability that $x = 2$ or $x = 3$.

$$P(x \geq 2) = \binom{3}{2}(0.073)^2(0.927) + \binom{3}{3}(0.073)^3 \approx 0.0152$$

17. E
Looking at a table of the t-distribution with 14 degrees of freedom and an upper tail probability of 0.01 yields a t^* critical value of 2.624.

18. B

$$\sigma_{\bar{x}_1-\bar{x}_2}$$
$$= \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$$
$$= \sqrt{\frac{3.2^2}{30} + \frac{3.8^2}{40}}$$
$$\approx 0.838$$

19. B

The politician can expect 48% of the female vote, and females comprise 58% of the population of interest. Therefore, the politician can expect $(0.58)(0.48) = 27.84\%$ of the vote from registered women. Of the 42% of males, the politician can expect votes from 53% of them. Therefore, the politician can expect $(0.42)(0.53) = 22.26\%$ of the vote from registered men. Overall, the politician expects $27.84\% + 22.26\% = 50.1\%$ of the vote.

20. E

The five-number summary for the percentage of white children living in poverty is: 12.9, 14.8, 16, 16.8, 17.8. The five-number summary for the percentage of Asian children living in poverty is: 11.8, 17.5, 18.25, 19.8, 24.1.

Answer choices A and D can be eliminated since the back-to-back stemplot tells us nothing about any individual year. There are three outliers for the distribution of Asian percentages: 11.8, 23.5, and 24.1. Even with their removal, the range of Asian percentages would be larger than that for white children. Finally, the distribution of white percentages is skewed left, resulting in a mean smaller than the median, but the distribution of Asian percentages shows no clear skew. In fact, the average percentage of Asian children living in poverty is 18.49%. The spread (or variability) of Asian percentages is larger for both the range and the interquartile range.

21. D

Causation *cannot* be demonstrated by the correlation coefficient. Only a randomized, controlled experiment can demonstrate causation.

22. E

With a range of 100, it is not possible for all five values to be identical. In order to have a standard deviation of 0, the values would need to be identical.

23. D

The sampling distribution of sample proportions for $p = 0.40$ and $n = 16$ would be centered at

$$\mu_{\hat{p}} = p = 0.4$$

with a standard deviation of

$$\sigma_{\hat{p}} = \sqrt{\frac{p(1-p)}{n}} = \sqrt{\frac{(0.4)(0.6)}{16}} \approx 0.122.$$

24. C

The standard deviation of the sampling distribution is $\sigma/\sqrt{n}$. Therefore, the variance, which is the square of the standard deviation, is

$$\frac{\sigma^2}{n} = \frac{(2.8)^2}{10} = 0.784.$$

25. C
The segmented bar graphs represent the percentages in the armed services by gender, not counts. Therefore, we can only compare the percentage of men and women in the various services.

26. C
If A and B are independent, then $P(A \cap B) = P(A) \cdot P(B)$. Thus,

$0.21 = (0.4)P(A)$ and $P(A) = \frac{0.21}{0.4} = 0.525$.

27. C
In each case, a wait-time of 45 minutes is 2 standard deviations below the mean. For a normal distribution, the probability that a value will fall more than 2 standard deviations below the mean is 2.275%.
$P(z < -2) = 0.0228$ using the table, and on the TI-83/84:

normalcdf$(-1E99, 2, 0, 1) = 0.02275$.

28. E
We cannot state with certainty that our confidence interval will capture the population proportion. The interpretation of the 95% confidence level tells us that in the long run, 95% of similarly constructed intervals will capture the true population proportion.

29. E
The sample result will be contained in the confidence interval, more specifically in the middle. The margin of error provides us with information about confidence in finding a population value. We cannot state with certainty that the population proportion will be contained in the confidence interval. The approval rating of the president is likely to be between 47% and 55%.

30. A
We are testing a null hypothesis of $p = 0.8$ versus an alternative hypothesis of $p < 0.8$. We are performing a one-proportion z-test. The test statistic is

$$z = \frac{0.7 - 0.8}{\sqrt{\frac{0.8(1 - 0.8)}{50}}} \approx -1.768.$$

The p-value is $P(z < -1.768) \approx 0.039$.

31. B
Let $X =$ the amount of profit Ruth makes.

X	\$400	\$275	\$100
$P(x)$	0.65	0.15	0.20

$E(x) = \mu_x = \$400(0.65) + \$275(0.15) + \$100(0.20) = \$321.25$

32. C

This is a binomial setting with $n = 8$ and $p = (1 - 0.45) = 0.55$. Therefore, the mean is $np = (8)(0.55) = 4.4$ and the standard deviation is $\sqrt{np(1 - p)} = \sqrt{(8)(0.55)(0.45)} \approx 1.41$.

33. C

If $\log \hat{y} = 0.214 - 1.28(2)$, then $\hat{y} = 10^{0.124-1.28(2)} \approx 0.0045$.

34. E

We are not told that we have two independent simple random samples. This is one of the necessary conditions for finding a confidence interval for a difference in proportions.

35. C

The residuals show a curved pattern, so the linear model is not a good model for the data. The sum of the residuals is zero. The sum of the squares helps to build the standard deviation and is not zero unless all of the residuals are zero.

36. E

Undercoverage, because not everyone shops at a mall; *nonresponse*, because only people with a strong opinion may be willing to answer; *response bias*, because the different appearances of the two boys may influence the type of response each boy receives.

37. E

Of the listed statistics, only the median is resistant to outliers.

38. E

All of these are appropriately modeled with a χ^2 distribution.

Answer choices A and B are goodness-of-fit tests with $(7 - 1) = 6$ and $(14 - 1) = 13$ degrees of freedom, respectively.

Answer choices C and D are tests of independence. Choice E is a test of homogeneity. These three choices use a two-way table. For a two-way table, $df = (\text{rows} - 1)(\text{columns} - 1)$.

So, $df_C = (5 - 1)(3 - 1) = 8$; $df_D = (7 - 1)(2 - 1) = 6$;

$df_E = (8 - 1)(3 - 1) = 14$.

39. A

$$90\% \text{ CI: } \bar{x} \pm t^*_{14}\frac{s}{\sqrt{n}} = 23 \pm 1.761\left(\frac{6}{\sqrt{15}}\right) \approx 23 \pm 2.728$$

40. B

Calculate the standard deviation by first finding the expected value and the variance.

$E(X) = \mu_X = 1(0.13) + 3(0.17) + 5(0.25) + 7(0.24) + 9(0.21) \approx 5.460$

$$\begin{aligned}\mathrm{Var}(X) &= \sum (x - \mu_X)^2 P(x) \\ &= (1 - 5.460)^2(0.13) + \cdots + (9 - 5.460)^2(0.21) \approx 6.868\end{aligned}$$

$\mathrm{SD}(X) = \sqrt{\mathrm{Var}(X)} \approx \sqrt{6.868} \approx 2.621$