Name: _____ School:_____

1. Largetown high school has a total of 530 seniors and 27% of them drive themselves to school. At the same school 28% of the 490 juniors drive themselves to school. A simple random sample of 40 seniors and 40 juniors is taken. What is the probability that the survey will indicate that more juniors drive themselves to school than seniors?
    a. 0.460
    b. 0.540
    c. 0.100
    d. 0.340
    e. 0.620

2. A 95% confidence interval for the mean of a population is to be constructed and must be accurate to within 0.3 units. A preliminary sample standard deviation is 1.4. The smallest sample size n that provides the desired accuracy is
    a. 73
    b. 92
    c. 69
    d. 84
    e. 99

3. A square is centered at the origin. Its sides are parallel to the axes. A projectile is aimed at the center of the square. The coordinates of its impact point are independent standard normal random variables. If the probability that the projectile lands inside the square is 0.85, find the length of the side of the square.
    a. 2.23
    b. 3.52
    c. 1.84
    d. 4.74
    e. 0.92

Name: _____ School:_____

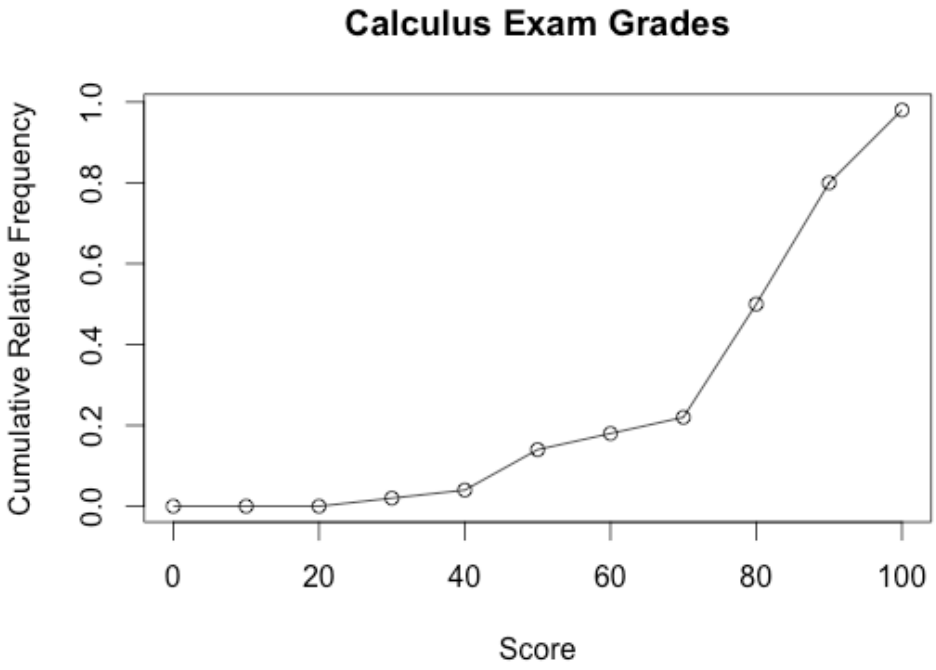
4. Suppose you wish to test if a number cube (die) is loaded or not. You roll the die 90 times and come up with the following distribution:

1	2	3	4	5	6
15	13	19	12	17	14

What type of test should be used in this situation and what is the test statistic?

a. One proportion z test; z = 0.163
b. χ^2 Goodness of Fit; $\chi^2 = 2.267$
c. Two proportion z test; z = 0.163
d. One proportion z test; z = 1.340
e. χ^2 Goodness of Fit; $\chi^2 = 4.074$

5. The figure below shows a relative cumulative frequency diagram of 50 scores on a calculus exam.



Which of the following conclusions can be made from the graph?

a. Over half of the scores are below 60.
b. The distribution of scores is skewed right.
c. The first quartile of the test scores are below 40.
d. A student is more likely to have a score between 60 and 80 than between 20 and 40.
e. The median grade is approximately 50.

Name: _____ School:_____

6. Suppose you wish to compare the grade point averages of students in your school based on their classification (freshman, sophomore, junior or senior). The best sampling procedure to use would be
   a. A simple random sample of all students at your school.
   b. A stratified random sample by classification of students at your school.
   c. A cluster sample where each cluster is a different classification.
   d. A multistage sample where the first stage is a simple random sample of all students at your school and the second stage involves clustering by classifications.
   e. None of these would be appropriate.

7. A hospital receives 1/5 of its flu vaccine shipments from Company A and the remainder of its shipments from other companies. Each shipment contains a very large number of vaccine vials. It is known that 10% of the vials among Company A's shipments are ineffective. For every other company, 2% of the vials are ineffective. The hospital tests randomly one vial of flu vaccines and finds it ineffective. What is the probability that this shipment came from Company A?
   a. 0.62
   b. 0.14
   c. 0.37
   d. 0.56
   e. 0.86

8. Use the p-value method along with the following data to evaluate the existence of a linear relationship between the average height of the two parents of a female child and the daughter's height.

Average height of parents	66	65.5	71.5	68	70	65.5	67	70.5	69.5	64.5	67.5
Child's height	64	63	69	69	69	65	63	68.5	69	64	67

   a. Yes and p=0.02
   b. Yes and p=0.01
   c. Yes and p=0.05
   d. Yes and p=0.002
   e. More data are required because p=0.16

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9. Scores on a nationwide professional qualifying exam are normally distributed and have a population mean of 720 and a population standard deviation of 40. An examinee scored at the 70th percentile nationally. To the nearest whole number, what was the examinee's numerical score?
   a. 741
   b. 699
   c. 761
   d. 732
   e. 726

10. A random variable X has the following probability distribution:

x	0	2	5	8	10	12	15
$P(X=x)$	k	$2k$	$3k$	k	$2k$	k	$4k$

    Find the expected value of X.

    a. 2.0
    b. 6.0
    c. 7.4
    d. 8.5
    e. 10.4

11. Among a large group of patients recovering from shoulder injuries, it is found that 22% visit both a physical therapist and a chiropractor, whereas 12% visit neither of these. The probability that a patient visits a chiropractor exceeds by 0.14 the probability that a patient visits a physical therapist. Determine the probability that a randomly chosen member of this group visits a physical therapist.

    a. 0.26
    b. 0.28
    c. 0.4
    d. 0.48
    e. 0.62

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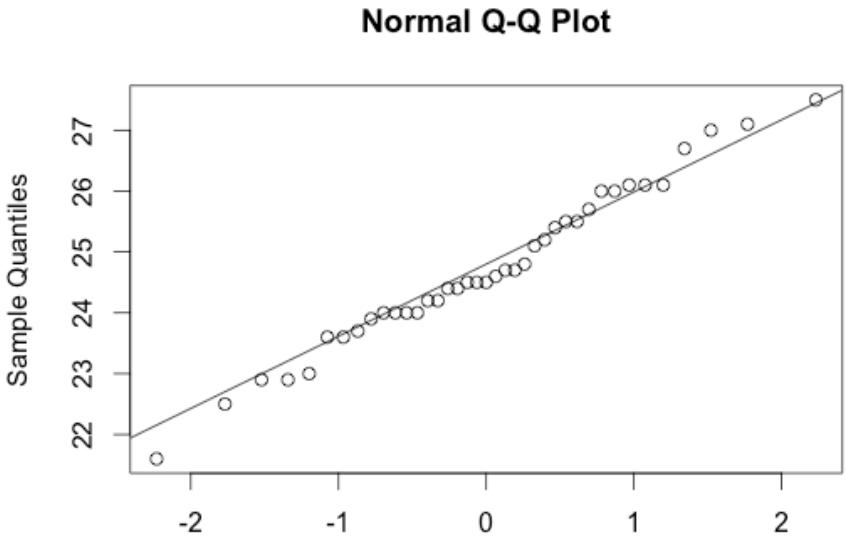
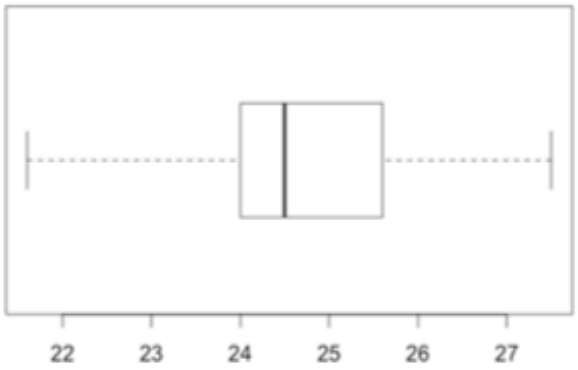
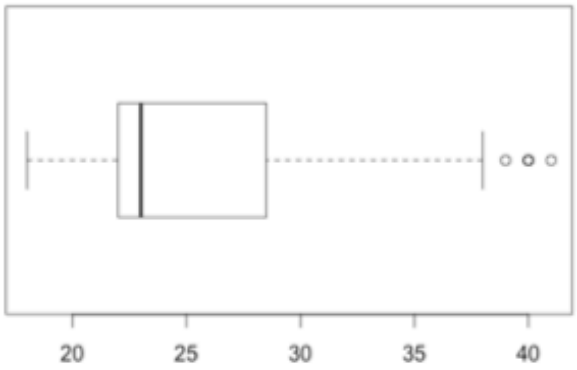
12. Which of the following boxplots could represent the data given in the following probability plot?



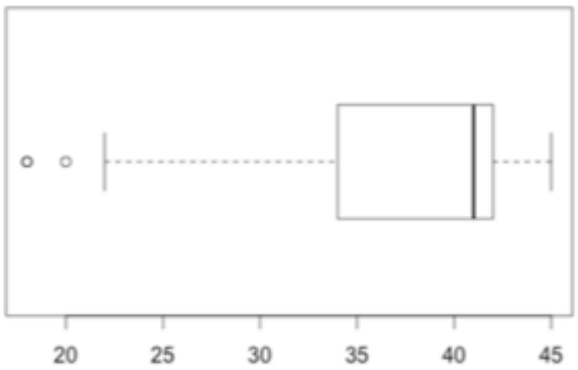
a.



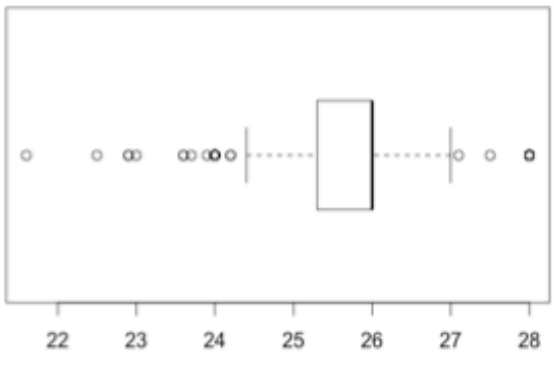
b.



c.



d.

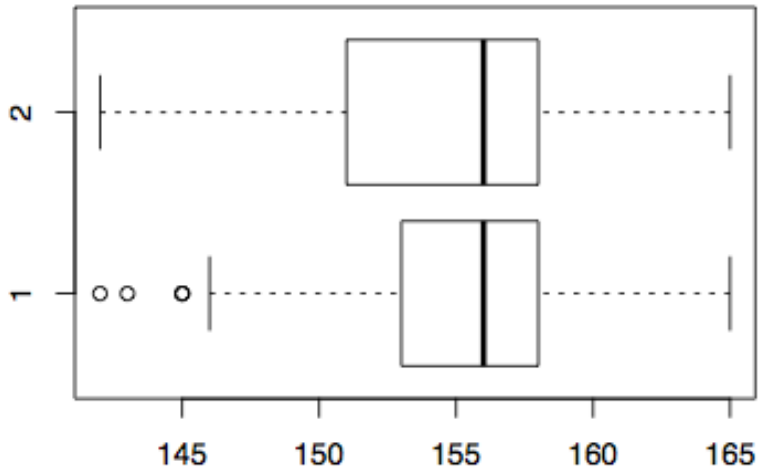


Name: _____ School:_____

13. How many words (not all of them having necessarily a meaning in the English language) can we form by shuffling the letters of the word ACTONA?

    a. 720
    b. 640
    c. 360
    d. 310
    e. 320

14. The boxplots shown below summarize two data sets, 1 and 2. Based on the boxplots, which of the following statements about these two data sets CANNOT be justified?



    a. Data set 1 and data set 2 have the same number of data points.
    b. The range of data set 1 is equal to the range of data set 2.
    c. The interquartile range of data set 1 is less than the interquartile range of data set 2.
    d. The median of data set 1 is equal to the median of data set 2.
    e. All of the above are valid statements.

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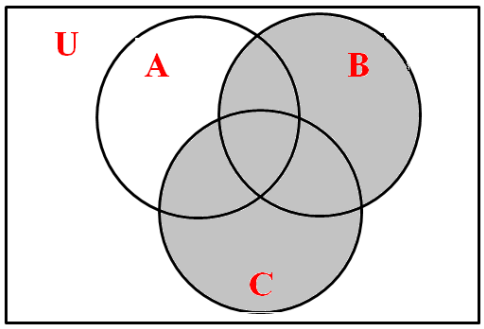
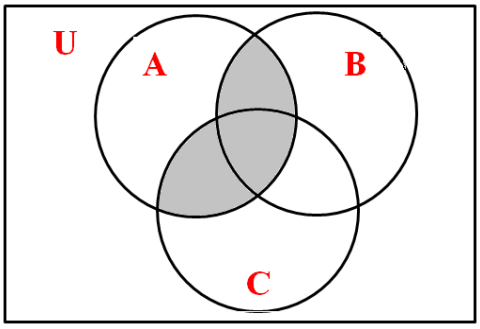
15. Which of the following is the correct Venn Diagram for $A \cap (B \cup C)$?

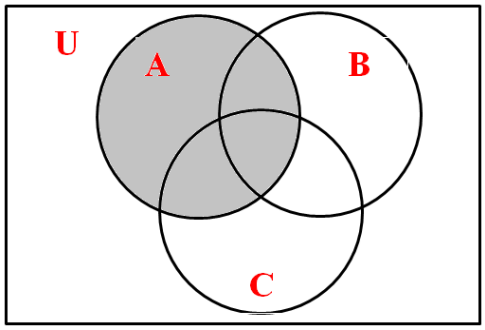
a.



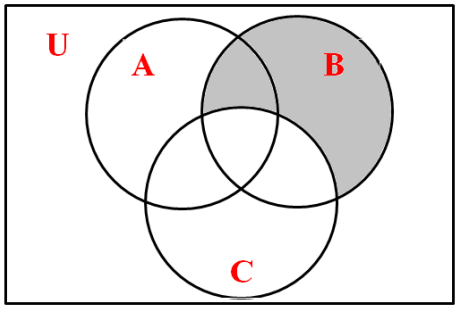
b.



c.



d.



e. none of these

Name: _____ School:_____

16. Given $P(E) = 0.56, P(F) = 0.37, P(E \cup F) = 0.78$, find $P(F \mid E)$.
    a. 0.4744
    b. 0.5676
    c. 0.2679
    d. 0.4054
    e. none of these

17. A distribution of grades in an introductory statistics class (where A = 4, B = 3, etc.) is:

x	0	1	2	3	4
$P(X = x)$	.10	.25	.30	??	.10

    Complete the chart and find the lowest grade x_0 such that $P(X \geq x_0) < 0.5$.
    a. 4
    b. 3
    c. 2
    d. 1
    e. none of these

18. In recent a public opinion poll in Greece, 1000 people were interviewed over the phone with regards to their intention to vote for one of the candidate political parties in the recent election in Greece. These 1000 people were selected among those who have a telephone landline. The sample of these 1000 individuals was selected to fit the recent socioeconomic and age, gender demographic criteria of the general Greek population. What do you believe might be a setback in the sampling process? Assume that all of the 1000 people responded to the pollsters.
    a. More than 1000 people were needed.
    b. People generally have multiple telephone landlines.
    c. In general, younger voters do not have a telephone landline, most have only a cell phone.
    d. Those who do not pay their telephone bill because they are unemployed cannot participate in the study because their landlines are disconnected.
    e. None of the above.

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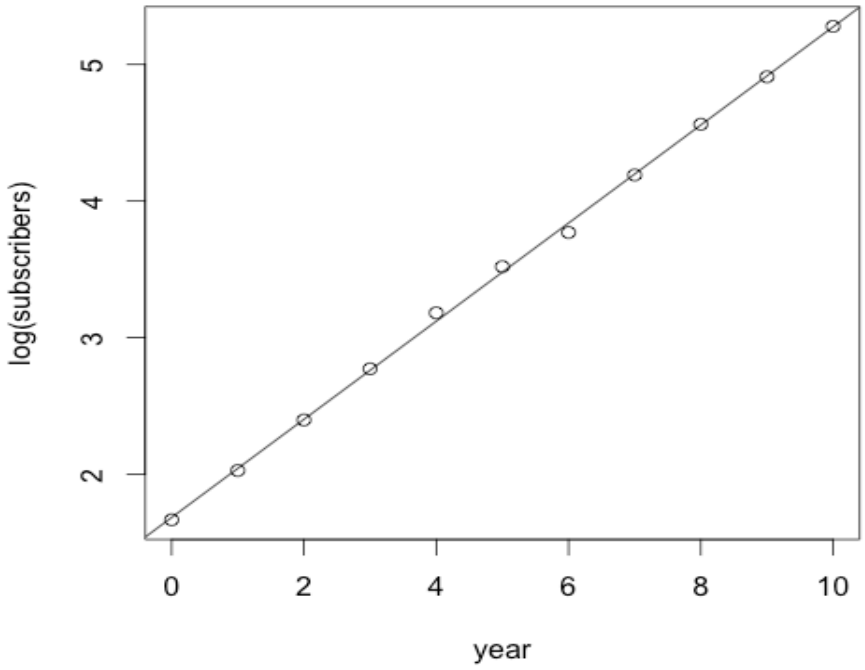
19. According to a study, the number of cellular phones in a state has increased dramatically over the years. The software output figure below gives the least squares regression of the natural log of the number of subscribers (in millions) as a function of years. What is the predicted value of the number of cellular phones in that state at year 6?



a. 403.43 million
b. 3.6 million
c. 36.6 million
d. 0.56 million
e. none of these

20. Suppose you have a sample of n = 49 subjects where the population standard deviation is $\sigma = 20$ and you wish to test against the null hypothesis of $H_a : \mu < 55$ with significance level of $\alpha = 0.07$. After your test, it is determined that the population mean is $\mu = 47$. What is the power of this test?

a. 0.07
b. 0.93
c. 0.09
d. 0.91
e. none of these

Name: _____ School:_____

21. How many words (not all of them having necessarily a meaning in the English language) can we form by shuffling the letters of the word ACTIVE?

    a. 720
    b. 130
    c. 60
    d. 120
    e. 65

22. An appropriate 95% confidence interval for μ based on $n = 15$ observations from a normally distributed population has been calculated to be $(-0.73, 1.92)$. The hypotheses of interest are $H_0 : \mu = 0$ vs. $H_a : \mu \neq 0$. Based on this confidence interval,
    a. we should not reject H_0 at the $\alpha = 0.10$ level of significance.
    b. we should not reject H_0 at the $\alpha = 0.05$ level of significance.
    c. we should reject H_0 at the $\alpha = 0.10$ level of significance.
    d. we should reject H_0 at the $\alpha = 0.05$ level of significance.
    e. we cannot perform the required test since we do not know the value of the test statistic.

23. A medical researcher would like to prove that a new drug is effective for a certain health problem. The null hypothesis is that it is no more effective than a placebo. A type II error occurs when
    a. The researcher concludes that the drug is effective when in reality it is not.
    b. The researcher concludes that the drug is not effective when in reality it is very harmful.
    c. The researcher concludes that the drug is not effective when in reality it is effective.
    d. The researcher concludes that the drug is very effective when in reality it is only slightly effective.
    e. None of the above

24. A tool maker claims that his best product has an average lifespan of exactly 15 years. A quality control specialist was provided with data collected from a random sample of 48 people who used this product. Using the data, an average product lifespan of 18 years and a standard deviation of 4 years was calculated. A 99% confidence interval for the true mean lifespan of this product is closest to:

    a. $(16.513, 19.487)$
    b. $(13.513, 16.487)$
    c. $(16.868, 19.132)$
    d. $(11.412, 18.348)$
    e. $(17.462, 20.538)$

25. A random sample of size 16 is taken from a normally distributed population with mean of 5 and variance of 9. Find the probability that the sample mean is between 4 and 6.
    a. 0.6823
    b. 0.8176
    c. 0.2611
    d. 0.7401
    e. 0.9145