

1. C
2. B
3. D
4. C
5. A

6. D
7. B
8. C
9. A
10. B

11. C
12. A
13. D
14. B
15. D

16. E
17. D
18. A
19. A
20. C

21. B
22. D
23. C
24. B
25. A

26. E
27. E
28. A
29. C
30. B

Solutions:

1. **C.** When you add the numbers up, you get a total of 522. You divide by the number of numbers, 10 in this case, to get the mean of 52.2.
2. **B.** The mean of the discrete variable is 61.9. When you subtract the mean from each value, square the differences, multiply by the corresponding probability and add the results up, you get a variance of 431.39. The square root of this result is the answer.
3. **D.** Breaking up a population by a common variable and then doing an SRS of each subgroup is a stratified sample.
4. **C.** The sum of the means is $35+100+70 = 205$ minutes. The standard deviation of the triathlon is $\sqrt{5^2 + 20^2 + 10^2} = \sqrt{525} = 5\sqrt{21}$. Use the Z test on the graphing calculator for each endpoint. For the 220 minute mark, the probability of less than is .7436546883. For the 198 minute mark, the probability of less than is .3799908281. The difference between the probabilities is .3636638602, which rounds to .3637.
5. **A.** Because of the population standard deviation given, this is a Z problem. So we need to find the critical value at .91 to use in the formula. That critical value is 1.340755035. Plugging into the margin of error formula produces $500 = \frac{(1.340755035)(5000)}{\sqrt{n}}$. Solving for n gives a value of 179.7624063. So we need 180 people to meet the requirements of the problem.
6. **D.** Filling in the information into a three circle Venn diagram produces four variables. The three parts with 2 science classes and the part where a student is in all three science classes. Let a = Bio and Phy, b = Bio and Chem, c = Chem and Phy and d = all 3. The following equations can be created: $a + b + d = 22$, $a + c + d = 21$, $b + c + d = 19$ and $a + b + c + d = 25$ since 75 seniors are accounted for in the given information. This leads to $a = 6$, $b = 4$, $c = 3$ and $d = 12$. There are 63 seniors that are not in Biology. 13 of those $(10 + 3)$ are in Chemistry. Hence the answer is choice D.
7. **B.** With the information, you can build a tree diagram. We know 45% are male, so 55% are female. We know 60% of female students participate in extracurricular activities, so $.55(.6) = .33$ represent the total of the school so far who participate in extracurricular activities. Therefore, 17% of the school are males who participate in extracurricular activities to get up to the 50% total. So $.17 = .45x$. The probability a male participates in extracurricular activities is $\frac{17}{45}$, so the probability a male does not participate in extracurricular activities is $\frac{28}{45}$. The final answer is following the tree for male and not participate, which produces $\frac{45}{100} \left(\frac{28}{45} \right) = .28$.
8. **C.** The exact z score for a 5% test of significance is -1.644853626. Plugging in the values to get the raw score is $-1.644853626 = \frac{raw-225}{\frac{30}{\sqrt{225}}} \rightarrow raw = 221.7102927$. Plugging that in with the alternative mean produces $z = \frac{221.7102927-220}{\frac{30}{\sqrt{225}}} = .85514635$. This leads to a p value of

.8037649833, which rounds to .8038.

9. **A.** Create the differences for the results. It doesn't matter which order you do it as long as your hypothesis is correct from that perspective. I calculated (Before – After) with the hypothesis that the differences would be less than zero. This is a one sample T test because we don't know the standard deviation of the population difference. The test statistic was -2.526480851, leading to a p value of .016211028. It rounds to the answer.

10. **B.** First find the probability of a student scoring less than 90. $z = \frac{90-65}{10} = 2.5$, which leads to a p value of .9937903201. Then find the probability of a student scoring greater than 80, but less than 90. $z = \frac{80-65}{10} = 1.5$. This leads to a p value of .0668072287, but we must subtract the portion of the curve greater than 90. This is .0668072287 - .0062096799 = .0605975488. $\frac{.0605975488}{.9937903201} = .0609761914$, which rounds to .0610.

11. **C.** Adjust the standard deviation from 12 to 8 by multiplying by $\frac{2}{3}$. Multiply the original mean by $\frac{2}{3}$ to get $\frac{2}{3}(56) = \frac{112}{3}$. You must add $\frac{113}{3}$ to get to the curved mean of 75. So the transformation equation is $y = \frac{2}{3}x + \frac{113}{3}$. Plug 81 in for y and solve to get 65 for the original score.

12. **A.** This is a chi square goodness of fit test. The expected sales at each location is the same based on the problem. The mean of the observed values is 138, so each expected value is 138. Plugging into the chi square formula produces
$$\frac{(120-138)^2 + (150-138)^2 + (135-138)^2 + (140-138)^2 + (160-138)^2 + (123-138)^2}{138} = \frac{1190}{138} = 8.623188406$$
. This rounds to 8.62.

13. **D.** The critical value for the 86% confidence interval is 1.476 to three decimal places.

Plugging the values in produces $(.83 - .79) \pm 1.476 \sqrt{\frac{(.83)(.17)}{100} + \frac{(.79)(.21)}{100}}$, which leads to $.04 \pm .0817815891 = (-.0417815891, .1217815891)$. When you round both values to five decimal places, you get the answer.

14. **B.** This is a geometric situation because we are looking for the first Type A blood donor each day. The formula for the standard deviation is $\sqrt{\frac{1-p}{p^2}} = \sqrt{\frac{1-.3}{.3^2}} = \sqrt{\frac{.7}{.09}} = \sqrt{\frac{70}{9}} = \frac{\sqrt{70}}{3}$.

15. **D.** There are three types of cat food and each are at two calcium levels, so there are 6 total treatments in the experiment. Each requires 30 cats, so $6(30) = 180$ cats are needed.

16. **E.** Statement I is false. The two errors do not add to 1 every time. Statements II and III are true.

17. **D.** The formula for two random variables that are NOT independent to find their combined standard deviation is $\sigma_{X-Y}^2 = \sigma_X^2 + \sigma_Y^2 - 2r\sigma_X\sigma_Y$. In this problem we have 6A and 3B to create

first. So the standard deviation of the random variable 6A is $6(7) = 42$ and the standard deviation of the random variable 3B is $3(10) = 30$. Plugging into the formula produces $\sigma_{6A-3B}^2 = 42^2 + 30^2 - 2(.7)(42)(30) = 900$. Therefore, the standard deviation of $(6A - 3B)$ is 30.

18. **A.** The formula for a residual is observed – predicted. When you plug 64 in for the midterm and evaluate, you get 72. Since Jennifer’s residual is 8 and her predicted score is 72, the equation is $8 = \text{observed} - 72$, leading to an observed value of 80.

19. **A.** This is a binomial distribution. 85 and 94 are the endpoints of the interval. The calculation is $\text{binomcdf}(100, .92, 94) - \text{binomcdf}(100, .92, 84) = .8142739765$, which rounds to .8143.

20. **C.** The formula for standard deviation for a 2 sample proportion test is

$$\sqrt{p^*(1-p^*)\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}, \text{ where } p^* = \frac{x_1+x_2}{n_1+n_2}. \text{ Plugging in produces } \sqrt{\frac{140}{200}\left(\frac{60}{200}\right)\left(\frac{1}{100} + \frac{1}{100}\right)} = \sqrt{\frac{7}{10}\left(\frac{3}{10}\right)\left(\frac{1}{50}\right)} = \frac{\sqrt{21}}{50\sqrt{2}} = \frac{\sqrt{42}}{100}.$$

21. **B.** Create two equations from the given information and the calculation of the z-scores using InvNorm. They are $86 - M = .99S$ and $62 - M = -.5S$. Solving these equations gives $M = \frac{10438}{149}$ and $S = \frac{2400}{149}$. The difference $(M - S)$ is the solution.

22. **D.** Since $P(A) = .65$ and the union is .79, that tells you that the region $P(A' \cap B) = .14$ and $P(A' \cap B') = .21$. Using the formula for union, $(A \cup B) = P(A) + P(B) - P(A \cap B)$, produces $.79 = .65 + P(B) - .65P(B) \rightarrow .14 = .35P(B) \rightarrow P(B) = .4$. Therefore, the intersection between $P(A)$ and $P(B)$ is .26. Plugging into the expression produces $P(B'|A) + P(A'|B) = \frac{P(B' \cap A)}{P(A)} + \frac{P(A' \cap B)}{P(B)} = \frac{.39}{.65} + \frac{.14}{.4} = .95$.

23. **C.** This is a discrete distribution. To find the expected value, multiply the result by its probability and add the products. $7(.4) - 10(.1) - 7(.2) - 12(.3) = -3.20$.

24. **B.** In order for the game to be fair, the mean of the game must be zero. So, $(\text{win})(.4) - 10(.1) - 7(.2) - 12(.3) = 0$. When you solve, you get $\text{win} = 15$. So Scarlett must continue to play the game until 15 is the possible win. Scarlett must play 9 games to reach this amount (7,8,9,10,11,12,13,14,15).

25. **A.** The correlation coefficient is the square root of the coefficient of determination, or .65. Plugging into the line of best fit formula produces $y - 75 = (.65)\left(\frac{12}{2}\right)(x - 3)$, which leads to $y - 75 = 3.9(x - 3)$, $y = 3.9x + 63.3$. This is choice A in fraction form.

26. **E.** Plugging the given information into the 2-Samp T-Interval program on the calculator, we get the interval $(1.82341705, 8.1765829) \rightarrow (1.82342, 8.17658)$, which is none of the given answer choices

27. **E.** Statement II is the only statement that is true. An outlier can be close to the line of best fit and therefore have a small residual. The same can be said of statement II that outliers in both variables can be a point near the line of best fit. Statement III is false because the outlier may be close to the line of best fit and therefore not sharply affect the equation of the line of best fit.

28. **A.** The conclusion was to reject the null, indicating a population mean of less than 45 and the population mean is actually less than 45. The test is significant because you rejected the null. The correct conclusion was made regarding the population.

29. **C.** First find the z scores representing the first and third quartile by using $InvNorm(.25) \approx -0.67449$ and $InvNorm(.75) \approx 0.67449$. The IQR between them is 1.34898 and when you multiply by 1.5, you get 2.02347. Add that to the third quartile and subtract from the first quartile to create the interval (-2.69796, 2.69796). Anything outside this interval is an outlier which occurs with probability $0.0069766 \rightarrow 0.00698$.

30. **B.** Create a tree diagram. 8% have the flu and 92% don't. Of the 8%, 97% test positive and 3% don't. Of the 92%, 2% test positive and 98% don't. The probability of a person testing positive is $(.08)(.97) + (.92)(.02) = .096$. The probability of a person having the flu and testing positive is $(.08)(.97) = .0776$. The final answer is $\frac{.0776}{.096} = .8083333333$, which rounds to .808.