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## Question: 1

Elizabeth desires to be in the 90th percentile of all students taking the verbal portion of the MCAT exam. Given that μ = 11 and σ = 1.5, approximately what score must she make to be in the 90th percentile?

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

**Answer: C**

Explanation:
In this situation, you should have a normal distribution of the form
$X \sim N(11, 1.5)$
Using the invNorm function of the graphing calculator, you will plug in the given values into the form: invNorm (%, μ, σ). Enter invNorm (0.90, 11, 1.5), and you get an answer of 12.92. This score rounds to 13.

## Question: 2

Jana must draw a name out of a hat. There are 15 names in the hat. On the first try, she draws Edward, which is her brother. She must replace the name. What is the probability that she will draw out the name Edward again?

A. 1/15
B. 1/225
C. 2/225
D. 2/15

**Answer: A**

Explanation:
This situation describes two independent events. Because the name is replaced each time, the probability of each outcome is the same for each try.

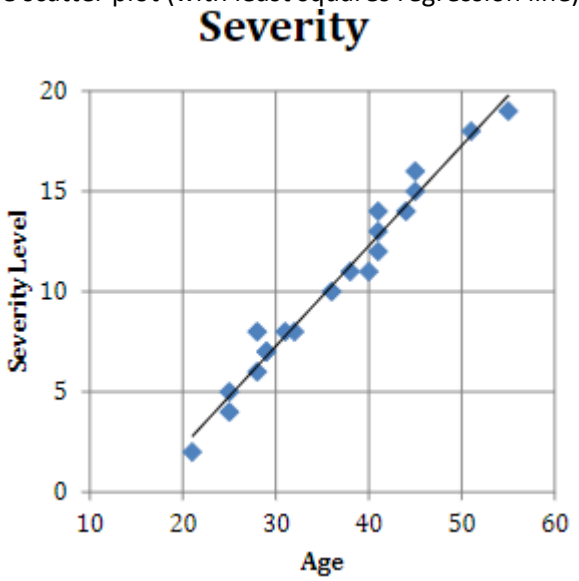
## Question: 3

A medical researcher wants to determine the correlation between age of patients with a fungal disease and severity level of the disease, categorized on a scale of 1 - 20. Plot the given data in a scatter plot, draw the least squares regression line, and find the equation for the least squares regression line.

| Age | Severity | | | Age | Severity | |
|---|---|---|---|---|---|---|
| 25 | 4 | | | 41 | 14 | |
| 45 | 16 | | | 44 | 14 | |
| 40 | 11 | | | 45 | 15 | |
| 55 | 19 | | | 41 | 12 | |
| 28 | 8 | | | 28 | 6 | |
| 29 | 7 | | | 29 | 7 | |
| 31 | 8 | | | 36 | 10 | |
| 21 | 2 | | | 38 | 11 | |
| 25 | 5 | | | 41 | 13 | |
| 32 | 8 | | | 51 | 18 | |

**Answer:**

The scatter plot (with least squares regression line) should look like:




= 7.73+0.5x.

The least squares regression equation that models the correlation is y =-7.73 + 0.5x.

Using the calculator, you simply enter the x-values into LI and enter they-values into L2. Then, go to Stat, Calculate, and lastly LinReg (a + bx). Enter L1, L2 and click "enter". Doing so will give you the and b values you need.

To calculate the least squares regression equation manually, begin by calculating the sum of squares for $x$ and sum of squares for y (27,921 and 2584, respectively). Then find $\bar{X}$, the sample mean of $x$,by summing the $x$-values and dividing by n, $\frac{725}{20} = 36.25$, and $\bar{Y}$, the sample mean of y, by summing the $y$-values and dividing by n: $\frac{208}{20} = 10.4$.

Then, calculate the slope, $b = \frac{SS_{xy}}{SS_{xx}}$ by first finding each part:

$S_{xx}$ is found by starting with the raw sum of squares for $x$ and subtracting the quantity ($n$ multiplied by $\bar{X}^2$). In other words, you have: $S_{xx} = 27921 - 20(1314.06) = 1639.8$.
$S_{xy}$ is found by summing the products of $(X - \bar{X})(Y - \bar{Y})$. $S_{xy} = 796$
Thus, $b = \frac{SS_{xy}}{SS_{xx}} = \frac{796}{1639.8} = 0.49$
Next, calculate the y-intercept using $a = \bar{Y} - b\bar{X}$:

$$a = 10.4 - 0.49(36.25) = -7.36$$

Putting the slope and y-intercept into the equation gives:
$y = -7.36 + 0.49x$
This answer is slightly different from the answer given by the graphing calculator, simply because of rounding.

## Question: 4

A top vehicle manufacturing company decides to increase vehicle costs on all models by 3 percent to balance the growing overhead costs. The current standard deviation for vehicle prices is $2000. What will be the standard deviation for the new vehicle prices?

A. 60
B. 600
C. 2060
D. 2600

**Answer: C**

Explanation:
Since each buyer will pay 3 percent more per vehicle, the new vehicle price will be:
new vehicle rice = 1.03 (old vehicle price)
To find the new standard deviation, you simply multiply the absolute value of the new vehicle price by the old standard deviation. Thus, 1.03(2000) = 2060

## Question: 5

The proportion of students from A&M, using the following banks during 2008 along with data from a random sample 200 students in 2009 are listed below:

| Bank | Compass Bank | Wells Fargo | Commerce National | Bank of America | Other |
|---|---|---|---|---|---|
| 2008 Proportion | 0.27 | 0.31 | 0.14 | 0.24 | 0.04 |
| 2009 Count | 70 | 88 | 21 | 15 | 6 |

The accounting division at Texas A&M University wants to determine whether or not these findings are consistent with the findings from 2009 at a = 0.05. Show the process.

**Answer:**

The results for percentage of students using each bank in 2009 are different from the results recorded in 2008. Since students are classified according to categories of banks, and you are given percentages of each, you can use a chi-square goodness of fit test.
Lees suppose the following:
$H_o$: The proportion of students using each bank in 2009 is the same as in 2008.
$H_1$ : The proportion of students using each bank in 2009 is different from the proportion in 2008.
Compare the actual number of students using each bank in 2009 to the expected number of students using each bank in 2009, based upon the percentage data you were given for 2008.
Therefore, take the sample size and multiply it by the 2008 percentage for each bank.

| Bank | Compass Bank | Wells Fargo | Commerce National | Bank of America | Other |
|---|---|---|---|---|---|
| Observed | 70 | 88 | 21 | 15 | 6 |
| Expected | 54 | 62 | 28 | 48 | 8 |

The $df$ is equal to 4 (5 categories minus 1) and the $\chi^2$ formula is:

$$\chi^2 = \sum_{i=1}^{5} \frac{(O_i - E_i)}{E_i} = 40.58$$

For $\chi^2 = 40.58$ and $df = 4$, $p < 0.0001$. Since $0.0001 < 0.05$, reject the null hypothesis. Thus, the percentage of students using each bank in 2009 is different from the percentage of students using each bank in 2008.

## Question: 6

The principal at Lake Mary High School wants to determine the effects of a new mathematics curriculum on student's final scores. She wishes to compare the new curriculum with two sets of old curriculum. Students taught by Teacher A, Teacher B, and Teacher C will be used in the sample. The students taught by each teacher are exposed to different teaching methods. Which design would be the best choice when comparing the effects of the three curricula?

A. Completely randomized design
B. Randomized block design
C. Matched pairs design
D. Replicated design

**Answer: B**

Explanation:
Since there are two factors at play: curricula and placement with teacher, the outcome can be influenced by either the treatment (curricula) or other blocks associated with Teacher A and Teacher B. This randomized block design could be broken up according to teacher (Teacher A or

Teacher B) and then further broken into blocks for each of the three curricula per teacher.
Choice A is not correct because the problem does state that the students are broken up according to teacher. With a completely randomized design, patients are randomly assigned to each group. This process differs from randomized block design, since the latter will randomly assign students taught by each teacher to the three groups of curricula.
Choice C is not correct because there is not a pre-post situation occurring. You are not examining a pre-test, the effect of the curriculum, and a post-test.
Choice D is not correct because you are not giving the same curricula time and time again, or giving it to different groups than the ones described. Replication is used to determine if you will get similar results the second time around.

## Question: 7

Provide an example to illustrate the Law of Large Numbers. Explain each part of the example. Be certain to state the meaning of the law within the explanation.

## Answer:

There are limitless examples of the law of large numbers. One such example would be the number the arrow on a spinner points to after each spin. If the spinner is divided into 8 sections, with 8 numbers, labeled 1 - 8, there is a 1/8 chance of the arrow landing on a 3. If you spin the spinner 10 times, you will get an experimental probability that approaches the theoretical probability of 1/8. If you spin the spinner 100 times, the experimental probability will be even closer to 1/8. Thus, the law states that as the repetitions of an experiment increase, the experimental probability mirrors or approaches the theoretical probability.

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