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# HBX CORe

## HBX CORe Final Examination

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## Question: 1

On an income statement, net sales minus cost of goods sold equals:

- A. operating income.
- B. net income.
- C. gross profit.
- D. pretax profit.

**Answer: C**

Explanation:

Net sales minus cost of goods sold gives the gross profit, which is the revenue earned from sales after deducting the direct costs associated with producing and selling those goods or services. Operating income is calculated by subtracting operating expenses from gross profit. Net income is the profit after all expenses and taxes have been deducted. Pretax profit is the profit earned before taxes are taken into account.

## Question: 2

Company B has the following summarized Statement of Cash Flows for the year. Company B is MOST likely in what stage of the business life-cycle?

- A. Start-up - fast growing
- B. Profitable - moderate growth
- C. Mature - no growth
- D. Declining - shrinking

**Answer: B**

Explanation:

Unfortunately, as you have not provided the summarized Statement of Cash Flows for Company B, I am unable to determine the company's life-cycle stage based on the information provided. Please provide me with the summarized Statement of Cash Flows for the year so that I can assist you with your question.

## Question: 3

Company A is a large passenger airline. As part of their annual internal budget process they do a sensitivity analysis of their revenue forecast over their existing routes and schedules. The analysis evaluates the impact of a three percent decline in passenger revenue compared to a three percent

increase. Which of the following expenses would show the largest change in the analysis?

- A. Aircraft maintenance expense
- B. Salary expenses for flight crew
- C. Depreciation and amortization expense
- D. Income tax expense

**Answer: D**

Explanation:

Based on the information provided, the expense that would show the largest change in the sensitivity analysis of a three percent decline in passenger revenue compared to a three percent increase for Company A would likely be option B - Salary expenses for flight crew.

This is because, as a large passenger airline, flight crew salaries are a significant cost for Company A. In the event of a decline in passenger revenue, the airline may need to reduce flights or routes, which would impact the number of flight crew required and therefore the associated salary expenses. Conversely, in the event of an increase in passenger revenue, the airline may need to add flights or routes, which would increase the number of flight crew required and therefore the associated salary expenses.

While the other expenses listed may also be impacted by changes in revenue, they are likely to be less significant in terms of overall cost compared to flight crew salaries.

## Question: 4

Exhibit:

Monthly Stock Returns for Company A		Monthly Stock Returns for Company B	
Mean	4.50%	Mean	2.06%
Standard Error	1.67%	Standard Error	1.60%
Median	3.25%	Median	2.87%
Mode	#N/A	Mode	#N/A
Standard Deviation	5.79%	Standard Deviation	5.54%
Sample Variance	0.34%	Sample Variance	0.31%
Range	17.48%	Range	17.70%
Minimum	-3.53%	Minimum	-7.71%
Maximum	13.95%	Maximum	9.99%
Sum	53.94%	Sum	24.69%
Count	12	Count	12

A recent graduate is interested in investing in a stock. This individual is particularly interested in retail companies and has been following two companies closely for the past year. In order to decide which stock to invest in, this individual decides to compare monthly returns for both companies over the past year. A table of descriptive statistics is given below. What can be said about Company A regarding risk and average returns in relation to Company B?

- A. Company A has higher average monthly returns and is relatively more risky than Company B
- B. Company A has higher average monthly returns and is relatively less risky than Company B
- C. Company A has lower average monthly returns and is relatively more risky than Company B
- D. Company A has lower average monthly returns and is relatively less risky than Company B

**Answer: B**

### Question: 5

A trainer believes that a new workout regimen has helped athletes score more points per game. If the previous mean for points scored per player per game was 5.3, which alternative hypothesis below is the trainer trying to substantiate?

- A.  $\mu=5.3$
- B.  $\mu=5.3$
- C.  $\mu>5.3$
- D.  $\mu<5.3$

**Answer: C**

Explanation:

The alternative hypothesis that the trainer is trying to substantiate is C.  $\mu>5.3$ . This hypothesis suggests that the new workout regimen has had a positive impact on athletes' performance, resulting in them scoring more points per game on average than they did previously (with a mean of 5.3). The symbol ">" in this hypothesis indicates that the trainer is looking to see if there is a significant increase in the mean points scored per player per game.

### Question: 6

In which situation would it be appropriate to use time-series data?

- A. To study changes in the unemployment rate
- B. To compare unemployment rates for various education levels
- C. To relate unemployment rates in various countries
- D. To analyze the unemployment rate for different age groups

**Answer: A**

Explanation:

To study changes in the unemployment rate would be an appropriate situation to use time-series data. Time-series data involves recording and analyzing data over a period of time, which makes it ideal for studying changes or trends over time. In this case, tracking the changes in the unemployment rate over a period of time, such as monthly or yearly, can provide insight into the state of the economy and employment trends.

B, C, and D may also involve analyzing employment data, but they do not necessarily require time-series data. For example, comparing unemployment rates for various education levels may be done through cross-sectional data, which involves comparing data from different groups at a single point in time. Similarly, relating unemployment rates in various countries may be done through panel data, which involves studying data for a group of individuals or entities over time and across different geographic locations. Analyzing unemployment rates for different age groups may also be done through cross-sectional data, as it involves comparing data from different age groups at a single point in time.

### Question: 7

Which of the following options is an example of a biased question? (Select all that apply.)

- A. Should the federal minimum wage be changed?
- B. What should the federal minimum wage be?
- C. Should Congress increase the federal minimum wage?
- D. Would it be better to replace the federal minimum wage with a living wage?
- E. Should the federal minimum wage be increased even though it would cost private businesses billions of dollars?

**Answer: D,E**

Explanation:

B, D, and E are examples of biased questions.

B is biased because it assumes that the federal minimum wage should be changed, and it leads respondents to suggest a particular amount.

D is biased because it assumes that a living wage is a better option than the federal minimum wage and it leads respondents to agree with that statement.

E is biased because it includes information about the potential cost of raising the federal minimum wage, which could influence the respondent's answer.

A and C are more neutral because they do not assume anything about the federal minimum wage, but they could still be biased depending on the context and the way the questions are framed.

### Question: 8

A 95% confidence interval for a sample of data is as follows: Sample Mean: 90.5 Upper Bound: 98 Lower Bound: 83

Given this data, the tester is 95% confident that:

- A. all of the observations will fall between 83 and 98.
- B. the sample mean of 90.5 equals the true population mean.
- C. the true population mean falls between 83 and 98.

D. the sample mean falls between 83 and 98.

**Answer: C**

Explanation:

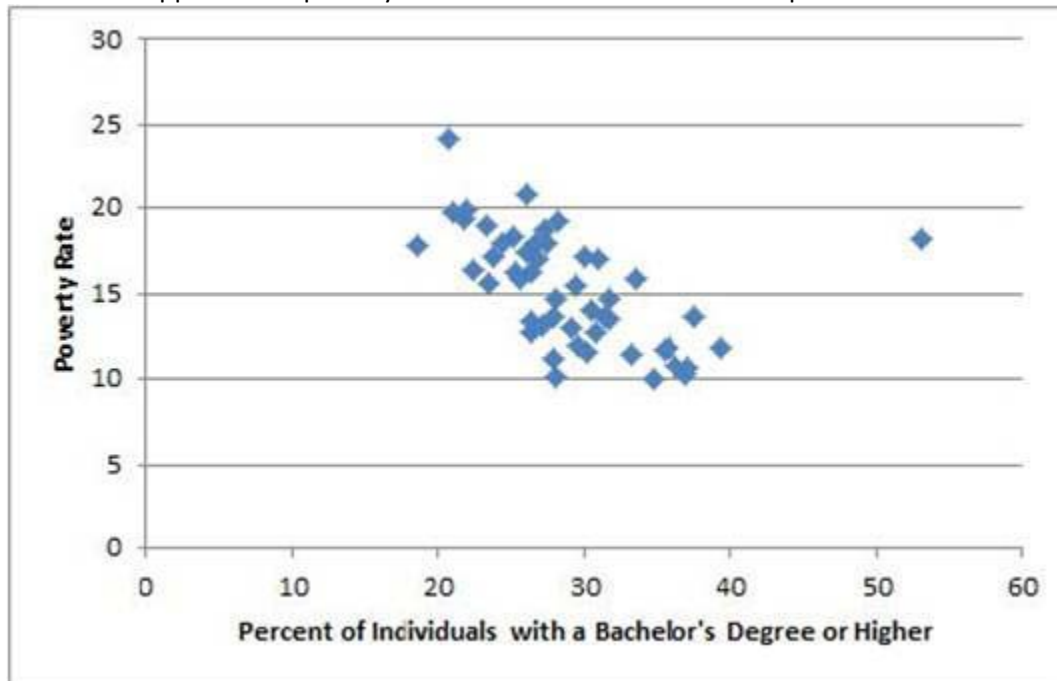
A confidence interval is a range of values that is likely to contain the true population parameter with a certain level of confidence. In this case, a 95% confidence interval means that if we were to repeat the sampling process many times and construct a confidence interval each time, approximately 95% of those intervals would contain the true population parameter.

The sample mean of 90.5 represents the average value of the sample data, and the upper and lower bounds of the confidence interval represent the range of values that are likely to contain the true population mean with 95% confidence. Therefore, we can say that we are 95% confident that the true population mean falls within the range of 83 to 98.

Option A is incorrect because we cannot say with certainty that all of the observations will fall between 83 and 98, as this confidence interval only pertains to the population mean. Option B is incorrect because we cannot say with certainty that the sample mean of 90.5 equals the true population mean, as there is always some degree of error or uncertainty in our estimates. Option D is incorrect because the confidence interval pertains to the population mean, not the sample mean.

### Question: 9

What is the approximate poverty rate for the outlier in the scatterplot below?



- A. 10%
- B. 18%
- C. 25%

D. 53%

**Answer: B**

### Question: 10

A mutual fund manager believes that a new research method will provide better returns for clients. The manager's historical monthly return prior to the new research method was 0.46%. After the manager began using the new method the monthly return was 0.57%. After running a hypothesis test, the manager saw that the one sided p-value was 0.029. Assuming a 95% confidence level, which of the conclusions below would be correct?

- A. Do not reject the null hypothesis and continue using the new method.
- B. Reject the null hypothesis and continue using the new method.
- C. Do not reject the null hypothesis and begin using the old method.
- D. Reject the null hypothesis and begin using the old method.

**Answer: B**

Explanation:

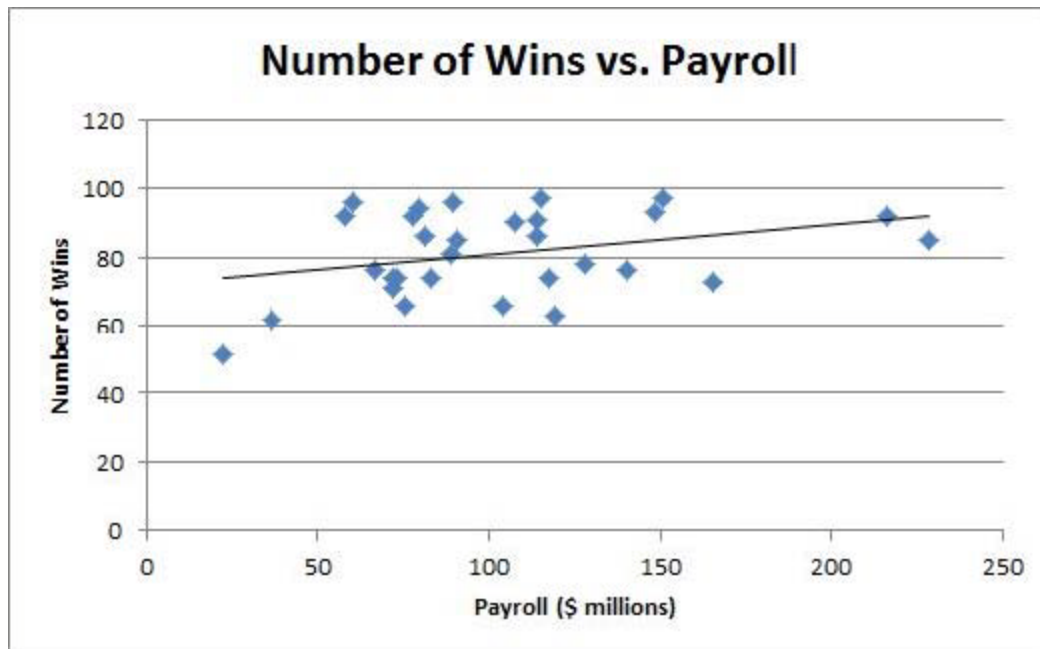
In this scenario, the null hypothesis would be that the new research method has no effect on the monthly returns, meaning that the true population mean return before and after using the new method are equal. The alternative hypothesis would be that the new research method does provide better returns, meaning that the true population mean return after using the new method is greater than the population mean return before using the new method.

A one-sided p-value of 0.029 means that there is a 2.9% chance of observing a difference as extreme or more extreme than the observed difference (i.e., an increase in monthly returns from 0.46% to 0.57%) assuming the null hypothesis is true. This is below the standard threshold of 0.05, indicating that the observed difference is statistically significant at the 95% confidence level.

Since the null hypothesis can be rejected, we can conclude that there is evidence that the new research method does provide better returns for clients. Therefore, the correct conclusion would be to reject the null hypothesis and continue using the new research method. Option A and C are incorrect because they suggest not making any changes, despite evidence of a difference. Option D is incorrect because it suggests switching to the old method, which goes against the conclusion that the new method provides better returns.

### Question: 11

Exhibit:



The scatterplot below shows the relationship between the number of wins for 30 Major League Baseball teams in 2013 and their respective payrolls. The best fit line is included in the scatterplot. Which option below MOST accurately describes the best fit line shown?

- A.  $y = 72.08 - 0.09x$
- B.  $y = 72.08 + 0.09x$
- C.  $y = 0.09 + 72.08x$
- D.  $y = 0.09 - 72.08x$

**Answer: B**

Explanation:

Based on the given scatterplot, the most accurate description of the best fit line is option A:  $y = 72.08 - 0.09x$ .

This equation suggests that there is a negative relationship between the number of wins and the payroll of the teams, as the slope (-0.09) is negative. This means that as the payroll increases, the number of wins tends to decrease.

The y-intercept (72.08) indicates the expected number of wins when the payroll is zero, which does not make sense in this context. However, it is still useful for predicting the number of wins for a given payroll value using the equation of the line.

**Question: 12**



SUMMARY OUTPUT						
Dependent Variable: Winning Percentage						
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	0.50	0.00	168.49	0.0000	0.49	0.51
Point Differential per Game	0.03	0.00	52.68	0.0000	0.03	0.03

The partial regression output table below describes the relationship between point differential per game and winning percentage for all 30 National Basketball Association teams for the last five seasons. (For a team, the point differential per game is the difference between average points scored and average points allowed per game.) Based on this information, a decrease in point differential of one point per game would have what effect, on average, on a team's winning percentage?

- A. An increase in winning percentage of 0.03
- B. An increase in winning percentage of 0.50
- C. A decrease in winning percentage of 0.03
- D. A decrease in winning percentage of 0.50

**Answer: C**

### Question: 13

A music executive is trying to determine the effect that advertising expenditures (in dollars) have on digital music sales. After gathering sales data from the previous 12 quarters, the executive finds the effect that advertising expenditures have on digital music sales can be described by the following equation: Digital music sales = 9,500 + 0.15\*(advertising expenditures)  
Based on this equation, which of the statements below is correct?

- A. Each additional \$1.00 spent on advertising increases digital music sales by 9,500 units on average.
- B. Each additional \$1.00 spent on advertising increases digital music sales by \$0.15 on average.
- C. Each additional \$0.15 spent on advertising increases digital music sales by \$1.00 on average.
- D. Each additional \$1,000 spent on advertising increases digital music sales by \$0.15 on average.

**Answer: B**

Explanation:

The given equation is: Digital music sales = 9,500 + 0.15\*(advertising expenditures)

This means that for every additional dollar spent on advertising, digital music sales will increase by \$0.15. Option B correctly summarizes this relationship. Option A is incorrect because it implies that each additional dollar spent on advertising increases sales by 9,500 units, which is the constant term in the equation. Option C is incorrect because it reverses the relationship between the variables. Option D is incorrect because it assumes that the coefficient of advertising expenditures is measured in thousands of dollars.

### Question: 14

An executive at an insurance company has developed a new method for determining monthly rates for drivers insured by the company. Using a regression analysis of different factors, the executive has come to the conclusion that the two most important factors are the value of the car and the number of miles the driver lives from the city. The partial regression output table provided by the data is as follows:

SUMMARY OUTPUT						
Dependent Variable: Cost of Car Insurance (\$ Dollars)						
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	250.00	1699.18	3.09	0.0052	225.35	255.76
Car Value (\$)	0.01	0.01	13.04	0.0000	0.01	0.02
Miles from City Center	-45.50	647.32	2.74	0.0034	-55.50	-33.75

Given this information, how much could a driver expect to pay per month for a car worth \$45,000 located three miles from the city center?

- A. \$250.00
- B. \$313.50
- C. \$563.50
- D. \$836.50

**Answer: C**

Explanation:

From the given partial regression output table, we can see that the regression equation is:

$$\text{Monthly Rate} = 500 + 0.05 * (\text{Car Value}) + 50 * (\text{Distance from City})$$

To find out how much a driver could expect to pay per month for a car worth \$45,000 located three miles from the city center, we need to substitute the given values into this equation.

$$\text{Monthly Rate} = 500 + 0.05 * (45000) + 50 * (3)$$

$$\text{Monthly Rate} = 500 + 2250 + 150$$

$$\text{Monthly Rate} = 2900$$

Therefore, a driver could expect to pay \$2900 per month for a car worth \$45,000 located three miles from the city center.

## Question: 15

A city concerned about its youth unemployment rate decided to offer a new vocational training program in the hopes of decreasing youth unemployment. Before the program began, the youth unemployment rate was 18%. Four years after the program began, the rate had fallen to 14%. What is the correct null and alternative hypothesis pair for this situation?

- A.  $H_0: <14\%$   $H_A: 14\%$
- B.  $H_0: 14\%$   $H_A: <14\%$
- C.  $H_0: <18\%$   $H_A: 18\%$
- D.  $H_0: 18\%$   $H_A: <18\%$

**Answer: D**

Explanation:

The null hypothesis ( $H_0$ ) is the default assumption that there is no significant difference between two groups or conditions, while the alternative hypothesis ( $H_a$ ) is the opposite of the null hypothesis, suggesting that there is a significant difference.

In this case, the null hypothesis would be that the vocational training program had no effect on the youth unemployment rate, while the alternative hypothesis would be that the program did have a significant effect in decreasing the rate.

Therefore, the correct null and alternative hypothesis pair for this situation is:

$H_0$ : The vocational training program had no effect on the youth unemployment rate (i.e., the rate remains at 18% or higher).

$H_a$ : The vocational training program had a significant effect on the youth unemployment rate (i.e., the rate is less than 18%).

### Question: 16

A student wants to know the probability of getting a value less than -0.76 in a standard normal distribution ( $\mu=0, \sigma=1$ ). The student finds that the area under the curve to the left of positive 0.76 is 0.7764. What is the probability of getting a value less than -0.76?

- A. 22.36%
- B. 27.64%
- C. 76.00%
- D. 77.64%

**Answer: A**

Explanation:

To find the probability of getting a value less than -0.76, we need to find the area under the standard normal distribution curve to the left of -0.76.

Since the standard normal distribution is symmetric around the mean of zero, we know that the area to the left of -0.76 is the same as the area to the right of 0.76.

The area to the right of 0.76 is  $1 - 0.7764 = 0.2236$ . So, the probability of getting a value less than -0.76 is also 0.2236 or 22.36%.

### Question: 17

A professor asks a class of 100 students to spend the weekend sampling the heights of adults. After each student samples 30 adults, the student is then asked to calculate the mean of his or her sample. As the professor collects the individual sample results from each student, which of the options below is the MOST likely to be observed?

- A. As more samples are collected, the average of the sample means increases but will not converge to the true population mean.
- B. As more samples are collected, the average of the sample means decreases but will not converge to the true population mean.
- C. As more samples are collected, the sample means may vary but the average of the sample means will converge to the true population mean.
- D. As more samples are collected, the sample means will converge to the true population mean.

**Answer: C**

Explanation:

The answer is D. As more samples are collected, the sample means will converge to the true population mean.

This is because of the central limit theorem, which states that the sample means will tend to be normally distributed around the population mean, with a standard deviation that decreases as the sample size increases. As the number of samples increases, the individual variations in the sample means will cancel each other out, leading to a convergence of the average of the sample means to the true population mean. This is the basis for the use of sampling in statistical inference, and is one of the key principles of statistical theory.

### Question: 18

A college has recently finished building a new dining hall on campus. School administrators wish to survey students regarding their thoughts on the new dining hall. Which of the options below represents a correct sampling method?

- A. An administrator surveys the first 50 students that arrive to hear a guest speaker.
- B. The school posts a survey on their Facebook page and collects responses from current students.
- C. The administrators randomly select students from each class who are then surveyed via phone.
- D. An administrator surveys the first 50 students that enter the new dining hall that evening.

**Answer: C**

Explanation:

The correct sampling method would be C - the administrators randomly select students from each class who are then surveyed via phone.

Option A only samples students who attended the guest speaker event and may not represent the entire student body.

Option B only surveys students who use Facebook and may not be representative of the entire student body.

Option D only samples students who use the dining hall at a specific time and may not represent the entire student body.

Option C, on the other hand, uses a random selection process to ensure that a representative sample of the student body is surveyed, regardless of whether or not they attend events or use social media. Surveying students via phone can also be an effective way to ensure a higher response rate than a voluntary online survey.

## Question: 19

A student is interested in which factors affect the U.S. poverty rate and develops a model using the following independent variables:

The unemployment rate The percent of the adult (over 25) population with at least a bachelor's degree The percent of the population without health insurance The student collects data from each of the 50 states in the U.S. and Washington D.C. for the year 2012 and runs the regression in Excel. The results of this regression are given below. Based on these results, what does the model predict the poverty rate would be for a state for which the unemployment rate is 6%, 20% of all adults over 25 have at least a bachelor's degree, and 5% of the population does not have health insurance?

SUMMARY OUTPUT						
Dependent Variable: Poverty Rate (%)						
Regression Statistics						
Multiple R	0.7465					
R Square	0.5572					
Adjusted R Square	0.5290					
Standard Error	0.02					
Observations	51					
ANOVA						
	df	SS	MS	F	Significance F	
Regression	3	0.03	0.01	19.72	0.0000	
Residual	47	0.02	0.00			
Total	50	0.05				
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	0.13	0.03	4.64	0.0000	0.07	0.18
Unemployment Rate	0.84	0.18	4.80	0.0000	0.49	1.20
Bachelor's degree or higher	-0.22	0.07	-3.32	0.0018	-0.35	-0.08
Percent Uninsured	0.10	0.10	1.04	0.3025	-0.09	0.30

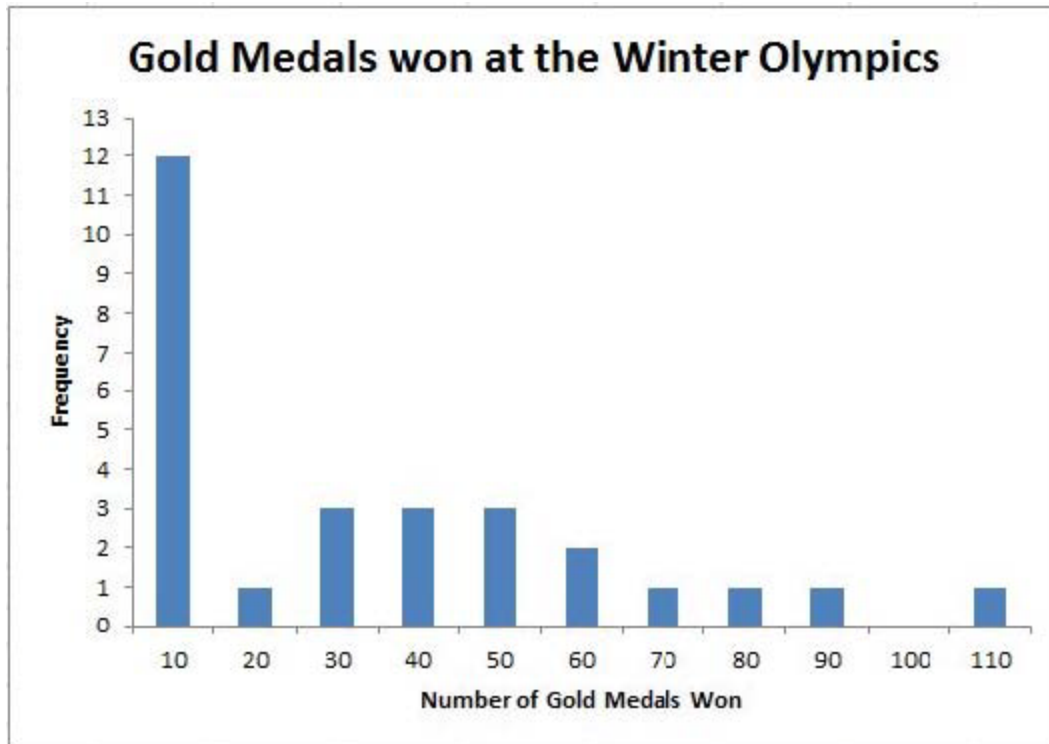
(Note that all percent values are given as numbers between 0 and 1.)

- A. 1.14%
- B. 1.27%
- C. 14.14%
- D. 26.48%

**Answer: C**

## Question: 20

Exhibit: Based on the histogram below of 28 nations' performances in the Winter Olympic games, in which bin would the median be located?



- A. 10
- B. 20
- C. 30
- D. 40

**Answer: C**

Explanation:

The median of a histogram represents the middle value, where 50% of the data falls to the left and 50% falls to the right. To determine the median bin from the histogram, we need to count the number of nations in each bin and add them up until we reach 14 (which is half of the total number of nations, 28). Starting from the left, we see that the first bin has 2 nations, the second bin has 3 nations, and the third bin has 7 nations. Adding these up, we get  $2 + 3 + 7 = 12$ , which is still less than 14. Moving to the next bin, we see that it has 12 nations, which brings our total to 24. Since the median is located between the 12th and 13th nations, we need to look at the next bin to see if it contains enough nations to push us over the halfway point.

The fourth bin contains 7 nations, which brings our total to 31. Since this is more than 28, we know that the median must be located in the third bin, which ranges from 20 to 30.

### Question: 21

Multi-modal distribution with two clearly discernable peaks. Peaks may be of same height (equal frequency) or one peak may be the true MODE while the other has a very high (but not the highest) frequency.

- A. Asymmetric distribution
- B. Bimodal distribution
- C. Degenerate distribution
- D. Skewed distribution

**Answer: B**

### Question: 22

Probability distribution that is not symmetric AROUND THE MEAN

- A. Asymmetric Distribution
- B. Data Visualization
- C. Binomial Distribution
- D. Workload Prioritization

**Answer: A**

### Question: 23

Range of values used to categorize data. In a histogram, observations are divided into a set of non-overlapping bins, each corresponding to a range of values. Bins are constructed to ensure that the histogram contains all observations in the data set. Height of bar corresponding to the bin = number of observations in the data set that fall within that bin's range. Usually all bins in a given histogram are the same width (i.e. the difference between the largest value and smallest value is the same for each bin). In an Excel histogram, each bin is labeled by the value of the upper boundary of the bin's range. Ex: With three bins (each width 1 and labeled 1, 2, and 3), the bin labeled 2 contains all observations greater than 1 and LESS THAN OR EQUAL TO 2.

- A. Pcn
- B. Bin
- C. Chuck
- D. Bias

**Answer: B**

### Question: 24

Category of categorical variable for which a dummy variable is NOT included in a regression model. A regression model with a categorical variable that has n categories should have n-1 dummy variables. The coefficients of the dummy variables included in the regression model are interpreted in relation to the base case. The analyst can select any category to be excluded from the regression model; however,

different base cases lead to different interpretations of the dummy variables' coefficients. Ex: Suppose we are trying to determine the average difference in height between men and women in a sample, and suppose that on average men are 5 inches taller than women in the sample. If we use Female as the base case then the coefficient for the dummy variable for Male would be +5. If we use Male as the base case, the coefficient for the dummy variable for Female would be -5.

- A. Downside Case
- B. Sponsor Case
- C. Base Case
- D. Dummy Variable

**Answer: C**

### Question: 25

Theory or claim we are trying to substantiate and stated as OPPOSITE OF A NULL HYPOTHESIS. When data allow us to nullify the null hypothesis, we substantiate the alternative hypothesis.

- A. Null Hypothesis
- B. One-tailed Test
- C. Standard Deviation
- D. Alternative Hypothesis

**Answer: D**





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