**Fundamental Questions on Statistics, Econometrics, Mathematics, Python, Excel, R, Probability, Financial Risk Management, and Financial Markets Solution**

Q1) Differential

From

Q2) integrate

From

Q3) Solve for x in

Divide both sides by 2

Q4) find the derivative of

Q5) the value of as x approach infinity

Q6) Probability of RED CARD from 52 CARDS

Number of red card = 26

P(RED) =

Q7) Conditional probability can be defined as the probability of an event occurring given that another event has already occurred.

Mathematically defined as P(A|B) =

**Example**

Suppose we want to find the probability of rolling a number grater than 4, given that the roll is an even number

Event A = {5, 6}

Event B = {2, 4, 6}

AnB = {6}

P(A|B) =

Q8) Total outcome of the coin toss = C:/Users/user/AppData/Local/Temp/wps.MdTZAZwps = 8

Possible outcome include

HHH, HHT, HTH,THH, THT, TTH,HTT,TTT

Probability of getting exactly 2 heads = 3/8

Q9) A random variable is a variable that represent numerical outcome of a random phenomenal or experiment.

Q10) P(AnB) in a mutually exclusive event is equal to 0

Event A Event B

There is no overlap in the set of event A and event B so therefore AnB = 0

Q11) mean, median and mode are measure of central tendency or can be describe as summary statistics

* **Mean** can be describe as the average of the distribution, represented mathematically as

μ =

* **Median** can be describe as the middle valve when the dataset is order from smallest to largest.

Eg 2, 4, 6, 8, median = = 5

* **Mode** is the most frequent occurring value in the dataset eg 2, 4, 4, 6, 8 mode = 4

Q12) variance can be describe as a measure of dispersion or spread in a dataset.

Mathematically represented as variance(σ²) =

Standard deviation is the square root of the variance . it brings the measure of spread back to the same unit as the data, making it interpret-able.

σ = √σ²

Q13) **sample** can be describe as representative subset of the population that is used in statistical calculation, due to large amount of resources that would be required to model a population

**Population** refers to the entire group of individual, items or events that you want to study or draw conclusion about.

Q14) A histogram is a graphical representation of the distribution of a dataset. It uses bars to show the frequency of the data points that fall within specific intervals.

**What it represent**

* Distribution shape
* Center and spread
* Patterns and outliers

Q15) The interquatile range (IQR) is defined as the difference in the 75th percentile and 25th percentile of the data.

Calculated as IQR = Q3 - Q1

Q16) Multicolinearity in regression analysis can be describe as a phenomenal where two or more independent variable are highly correlation.

Q17) Heteroscedasticity is a phenomenal in regression analysis where the variance of the error (residual) is not constant across all levels of the independent variable.

Q18) R-squared represent the variance of the dependent variable that can be describe by the independent variable. It’s a measure of good fit of the model.

It ranges from 0 to 1.

Q19) A time series is a sequence of data points collected or recorded at successive, evenly spaced points in time. It is typically used to analyze trends, patterns, and changes over time, making it valuable in forecasting and monitoring systems.

* Example of a Time Series

An example of a time series is daily stock prices of a company. Each day’s closing price represents a data point in the time series. Analysts can use this time series data to observe trends, assess volatility, and predict future stock prices based on historical patterns.

Another example is the daily NO2 present in the soil. Each data point measure certain metric which also include time dimension.

Q20) **Dependant variable** or the target is prediction of any model, its rely on certain inputs from the independent function or equation for its value

**Independent variable** is the variable that is manipulated or controlled by the researcher to observe its effect. It is the cause or input in the experiment or analysis. In statistical models, it’s also known as the predictor or explanatory variable. It does not depend on other variables in the analysis.

We can further analyse the difference with a simple linear regression formula

wps

Where y is dependant variable and x is the independent variable.

Q21) Normal distribution is a bell curved shape that represent most of the dataset that appear in the real word, eg height of individuals, students scores etc.

* They are symmetrical
* They have a mean of 0 and a standard deviation of 1
* 68-95-99.7 Rule (Empirical Rule): In a normal distribution:
  + Approximately 68% of data points lie within one standard deviation from the mean.
  + Approximately 95% lie within two standard deviations.
  + Approximately 99.7% lie within three standard deviations.

Q22) A binomial distribution is a probability distribution that models the number of successes in a fixed number of independent trials, each with the same probability of success. It applies in scenarios where there are exactly two possible outcomes (often called "success" and "failure") for each trial.

**Quality Control**: Determining the probability that a certain number of items in a batch are defective if each item has the same probability of being defective.

23) Poisson Distribution: The Poisson distribution models the probability of a given number of events occurring within a fixed interval of time or space, given the events happen independently and at a known average rate.

Example: Modeling the number of customer arrivals at a store per hour if the average rate is 10 customers per hour.

1. Uniform Distribution: In a uniform distribution, all outcomes in a range are equally likely. There are two types:

* Discrete Uniform Distribution: Outcomes in a set are equally probable, like rolling a fair die (each face has a 1/6 probability).
* Continuous Uniform Distribution: All values within an interval are equally likely, like choosing a random number between 0 and 1.

1. **Right (Positive) Skew:** The tail is longer on the right, meaning most data is concentrated on the left. This indicates a few high values pulling the mean to the right.

**Left (Negative) Skew:** The tail is longer on the left, meaning most data is concentrated on the right, with a few low values pulling the mean to the left.

26) Value at Risk (VaR) can be describe as risk management metric that estimates the maximum loss an investment portfolio might face over a specified time period, given a certain confidence level (e.g., 95%). It is used to assess potential losses and ensure adequate capital reserves.

27) Credit Risk in finance can be describe as the possibility that a borrower or counterpart will fail to meet their debt obligations, leading to financial loss for the lender or investor.

1. Market Risk can be describe as the risk of losses due to changes in market prices, including fluctuations in stock prices, interest rates, currency exchange rates, and commodity prices.

29) Operational Risk can be describe as the risk of loss resulting from inadequate or failed internal processes, people, systems, or external events, such as technical failures or fraud.

30) Risk Premium can be describe as the return in excess of the risk-free rate that an investor requires as compensation for the extra risk associated with an investment.

1. **Stock:** Represents ownership in a company and entitles the holder to a share of its profits.

**Bond:** Represents a loan from the investor to the issuer (like a corporation or government) and entitles the holder to fixed interest payments and repayment of principal at maturity.

32) Derivative in Financial Markets: A derivative is a financial instrument whose value is derived from an underlying asset, index, or rate. Common derivatives include options, futures, and swaps, often used for hedging or speculation.

33) Purpose of a Central Bank: A central bank regulates a country's monetary policy, controls inflation, stabilizes currency, sets interest rates, and may act as a lender of last resort also direct the activities of other banks in the nation. In Nigeria, the central bank is the CBN(Central Bank of Nigeria).

34)**Bull Market**: A period where asset prices are rising, indicating optimism and investor confidence.

**Bear Market**: A period where asset prices are falling, often signaling pessimism and risk aversion.

1. **IPO (Initial Public Offering)**: An IPO is the first sale of a company's shares to the public, marking the transition from a private to a public company. It is a way for companies to raise capital from public investors.
2. for i in range(1,6):

Print(i)

1. The len() function in python return the length of the variable that goes in it.
2. You can create a list in python by writing square bracket eg [1, 2, 3, 4, 5] this is a list of 1 to 5 in python
3. def square(n):

z = n \*\* 2

return z

square(4)

This code should output 16.

1. A dictionary in python is a type of data structure that stores data using a key-value pair format. Eg of university student dictionary declaration in python

studentA = {

“Name” : “ABCD”,

“Matric no” : “2416B”,

“ Age” : “22”

}

1. This `=AVERAGE(A1:A10)` will calculate the mean/average from cell A1 to cell A10.

**42. How to Create a Chart in Excel**:

* Select the data range you want to include in the chart.
* Go to the **Insert** tab on the Ribbon.
* Choose a chart type, such as **Column**, **Line**, **Pie**, etc., from the **Charts** group.
* Customize the chart as needed using the **Chart Tools** options (for example, adding titles, labels, and adjusting styles).

**43. Function to Find the Maximum Value in a Range**:

* Use the =MAX(range) function, where range is the set of cells you want to evaluate.
* Example: =MAX(A1:A10) returns the highest value within cells A1 through A10.

**44. Result of** =IF(A1 > 10, "Yes", "No") **if A1 is 15**:

* If cell A1 is 15, the formula =IF(A1 > 10, "Yes", "No") will return **"Yes"** because 15 is greater than 10.

**45. How to Perform a VLOOKUP in Excel**:

* Use the =VLOOKUP(lookup\_value, table\_array, col\_index\_num, [range\_lookup]) function.
* Parameters:
  + lookup\_value: The value you want to search for.
  + table\_array: The range containing the data (with the lookup column on the left).
  + col\_index\_num: The column number in table\_array from which to retrieve the result.
  + [range\_lookup]: Optional; use TRUE for an approximate match or FALSE for an exact match.
* **Example**: =VLOOKUP("Apple", A2:C10, 2, FALSE) searches for "Apple" in the first column of A2and returns the value from the second column of the row where "Apple" is found.