**SECTION A- DESCRIPTIVE SOLUTIONS**

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| 1 | a) | Explain regular components of a time series.  Solution:  \* An observed time series can be decomposed into three components; trend, seasonality  and residuals.  \* Trend and Seasonality are regular components of time series.  \* Forecast of time series involves estimation and extrapolation of these components.  \* Trend is a long-term movement of a series; either increasing or decreasing.  \* Seasonality represents intra-year stable fluctuations repeatable year after year with  respect to timing, direction and magnitude.  \* It is a normal variation that recur every year to the same extent. | 6 |
| b) | What is stationarity? How will you convert non-stationary series into stationary series? Solution:  \* Time series is considered as stationary series if;  1. The mean function is constant.  2. The variance function is constant.  3. The autocovariance and autocorrelation functions only depend on the lag.  \* A stationary time series is one whose properties do not depend on the time at which  the series is observed.  \* In general, a stationary time series will have no predictable patterns in the long-term.  \* Thus, time series with trends are not stationary — the trend will affect the value of the  time series at different times.  \* Differencing can help stabilise the mean of a time series by removing changes in the  level of a time series, and therefore eliminating (or reducing) trend and seasonality.  \* Differencing is performed by subtracting the previous observation from the current  observation.  difference(t) = observation(t) - observation(t-1) | 6 |
| c) | How will you determine the order of a moving average process? Explain.  Solution:  \* Time series can be characterised as moving average process when a value from a time series is regressed on past forecast  errors of the time series.  \* The order of a moving average is the number of immediately preceding forecasting errors in the series that are used to predict  the value at the present time.  \* The ACF is most useful for identifying the order of a moving average process.  \* An autocorrelation function is the correlation between time series observation and a lag of itself.  \* A partial autocorrelation function is the correlation between time series observation and a lag of itself that is not  explained by correlations at all lower-order-lags.  \* Graphical approaches to assessing the order of an autoregressive model include looking at the ACF and PACF plots.  \* In PACF plot, if you see large number of significant lags and slow decaying PACF values, but in ACF plot, if you see large ACF values at few initial lags indicate this value as a possible choice for the order of a moving average model. | 8 |