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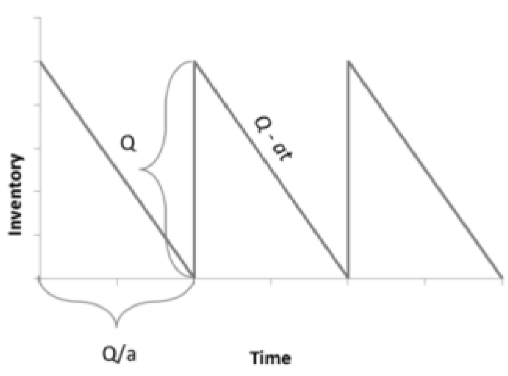
27 points is 10, 16 points is 4 (minimum positive grade)

1. Explain the graph and the intended parameters.

   An inventory-time graph, also known as an inventory profile or inventory plot, is a graphical representation of the level of inventory over time. It shows how the inventory level changes as goods are received, consumed, and replenished. The graph provides valuable insights into inventory dynamics and can be used for inventory management and planning.



   To understand the parameters associated with an inventory-time graph, let's consider the following parameters: Q, a, and t:

   i. Q (Order Quantity): Q represents the order quantity or batch size. It is the amount of inventory ordered each time a replenishment order is placed.
   ii. a (Average Demand Rate): a represents the average demand rate or average consumption rate of the inventory over a given time period. It indicates the average rate at which items are being used or sold.
   iii. t (Time between Replenishments): t refers to the time interval between consecutive replenishments or order placements. It represents the duration from one order placement to the next.

2. Which methods could be mentioned from Unconstrained Minimization Methods?

   Unconstrained minimization methods are numerical optimization techniques used to find the minimum value of a function without any constraints on the variables. Several methods can be mentioned from this category, including:

   a. Gradient Descent: It is a popular optimization algorithm that iteratively updates the parameters in the direction of the negative gradient of the objective function.
   b. Newton's Method: This method uses the second derivative (Hessian) of the objective function to find the minimum.
   c. Quasi-Newton Methods: These are variations of Newton's method that approximate the Hessian matrix to avoid its computation.
   d. Nelder-Mead Method: Also known as the downhill simplex method, it constructs a simplex (a geometric shape) in the parameter space and moves and expands this simplex to find the minimum.
   e. Conjugate Gradient Method: This iterative method finds the minimum by solving a sequence of linear equations in each iteration.
   f. Coordinate Descent: This approach optimizes one variable at a time while keeping others fixed. It iteratively updates each variable until convergence.
   g. Simulated Annealing: Inspired by the annealing process in metallurgy, this method uses a random search combined with a temperature parameter that gradually decreases over time.

3. Give examples of Forecasting Methods for a Constant Level Model.

   When dealing with a constant level model in forecasting, where the underlying process is assumed to have a constant mean or level over time, several forecasting methods can be applied. Here are a few examples:

   a. Naive Method: The naive method assumes that the future values will be the same as the most recent observed value
   b. Simple Average: The simple average method calculates the average of historical data and uses it as the forecast for future periods.
   c. Moving Average: The moving average method calculates the average of a fixed number of the most recent observations and uses it as the forecast for the next period.
   d. Exponential Smoothing: Exponential smoothing methods assign exponentially decreasing weights to past observations, with more recent observations receiving higher weights.
   e. Holts' Linear Trend Method: Holt's Linear Trend method extends exponential smoothing to account for a linear trend in the data.
   f. Regression Analysis: Regression analysis can be employed when there is a relationship between the dependent variable (the variable being forecasted) and one or more independent variables.

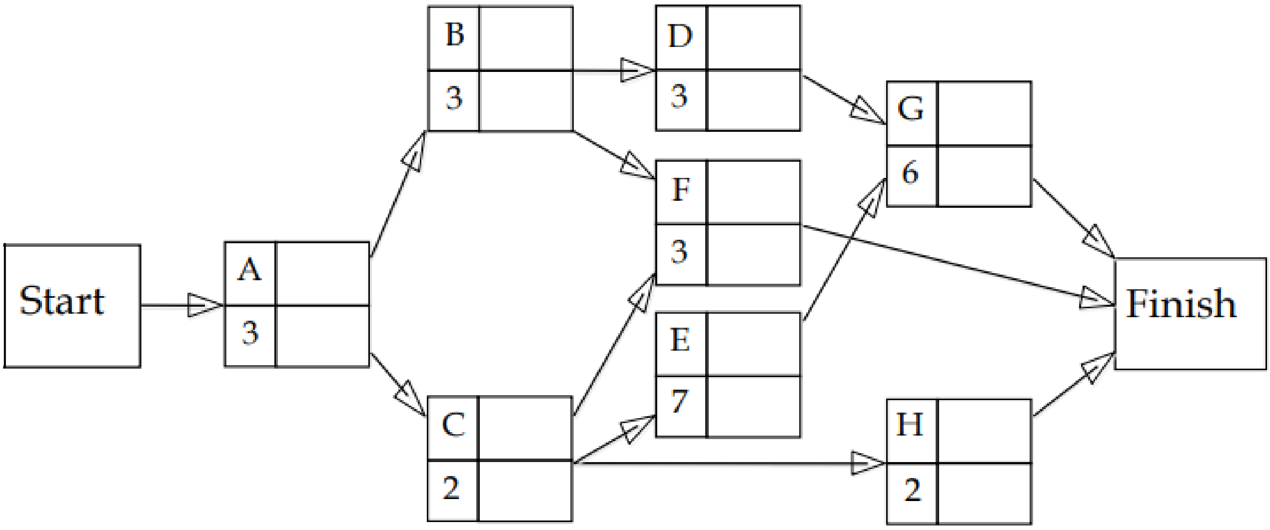
4. What are the general principles of Unconstrained Optimization and the parameters of the algorithm?

   The general principles of unconstrained optimization involve finding the minimum or maximum of an objective function without any constraints on the variables. The goal is to determine the optimal values of the variables that minimize or maximize the objective function. Here are the general principles and parameters commonly associated with unconstrained optimization algorithms:

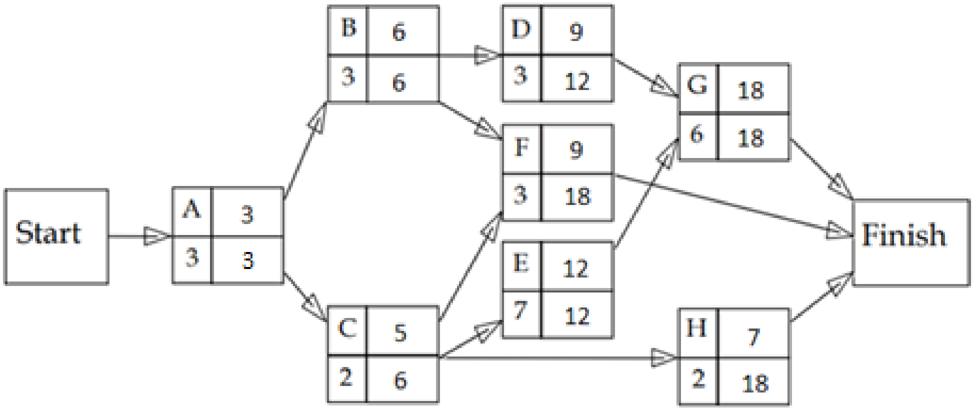
   a. Objective Function: Define the objective function that needs to be minimized or maximized. This function represents the quantity of interest and is typically a mathematical expression involving the variables.
   b. Variables: Identify the variables that affect the objective function.
   c. Initial Guess: Provide an initial guess or starting point for the optimization algorithm.
   d. Convergence Criteria: Define the criteria that determine when the optimization algorithm has converged to an acceptable solution.
   e. Gradient Information: Some optimization algorithms require information about the gradient (first derivative) or higher-order derivatives of the objective function.
   f. Post-Processing: Once the optimization algorithm has converged, post-processing steps can be performed to analyze the solution, validate it, and interpret the results.
   g. Optimization Algorithm: Choose an appropriate optimization algorithm that iteratively searches for the optimal values of the variables. Different algorithms have different characteristics and are suitable for different types of problems.

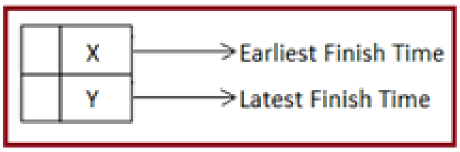
   It's important to note that the specific details and parameters of an unconstrained optimization algorithm can vary depending on the chosen method. Different algorithms have their own set of principles, techniques, and parameters.

5. Complete the critical path below.



Activity	Predecessor	Duration
A	-	3
B	A	3
C	A	2
D	B	3
E	C	7
F	B, C	3
G	D, E	6
H	C	2
FINISH	G, H	18





- The critical path is the longest path in a project schedule that determines the minimum time required to complete the project. In the given diagram, the critical path is as follows:
- START → A → C → E → G → FINISH
- The activities on the critical path are:
  - A with a duration of 3 units.
  - C with a duration of 2 units.
  - E with a duration of 7 units.
  - G with a duration of 6 units.
- The total duration of the critical path is 3 + 2 + 7 + 6 = 18 units. This means that any delay in any of the activities on the critical path will directly impact the overall project completion time.