

Characteristics Of Complex Business Problems

Important Definition:

Data-> Collected on daily basis in form of bits, numbers, symbols and object.

Information-> **Organized data** -> which are processed , cleaned, arranged into structures and stripped of redundancy.

Knowledge-> **Integrated information** -> which includes facts and relationships that have been perceived or discovered or learned.

Business Intelligences-> It is defined as a broad category of application programs and technologies for gathering, analyzing and providing access of data.

Aim of ABI(Adaptive Business Intelligence) Based System:

Solving real world business problems that have complex constraints are set in time changing environment and have several objectives and where the no. of possible solutions is too large to enumerate.

Characteristics Of Complex Business Problems:

- The number of possible solutions is so large that it precludes a complete search for the best answer.
- Problem exists in a time changing environment.
- The problem is heavily constrained.
- There are many (Possibly conflicting) objectives.
- Incomplete information, noisy data and uncertainty.

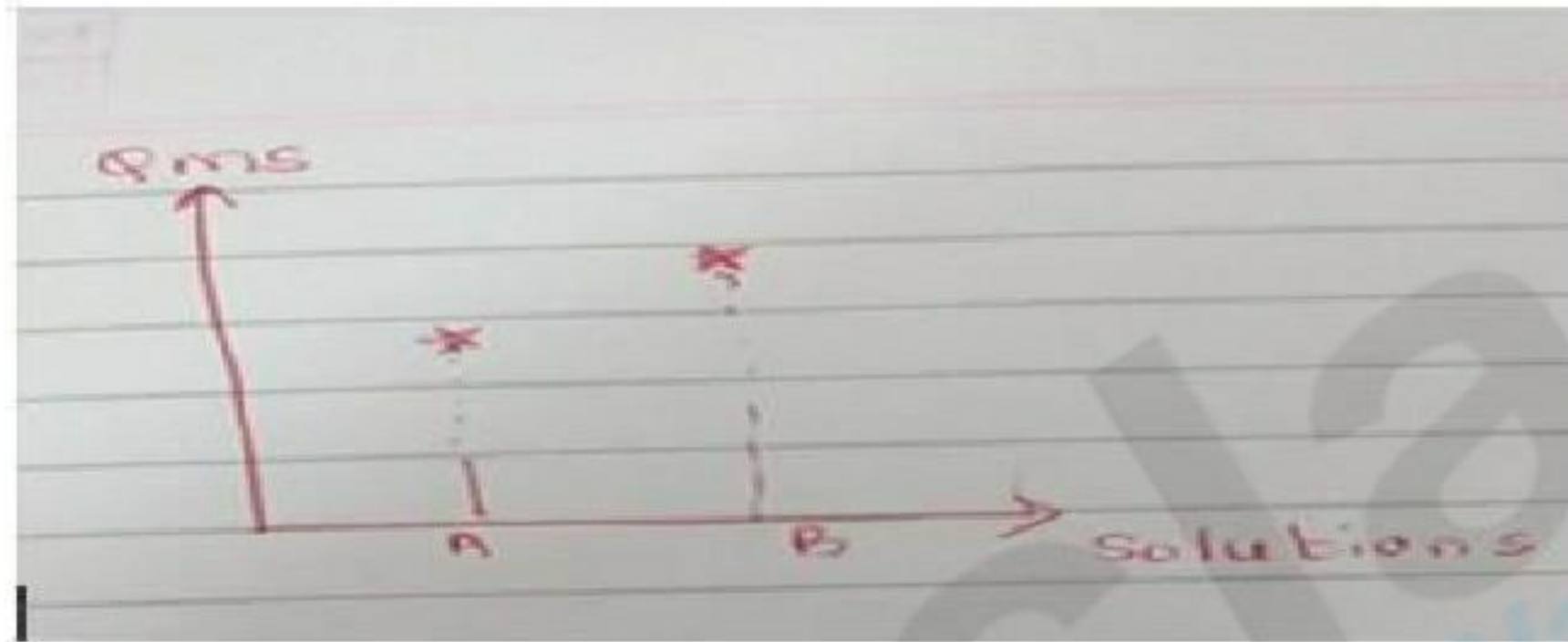
Number of possible solutions:

- To find best solution to a particular large problem with considering no. of decision variable, we have to consider each possible combination to find highest possible quality measure score and hence solution is better.
- For eg. Travelling Salesman Problem - Travelling the shortest possible distance, the salesman visit every city in his territory (exactly once) and then return home.
- For 7 cities (5040 possible solutions) as no of cities is directly proportional to no of solution . It can be a very large problem as no of city increases.
- Most real world business problem are far more complex than this. They are defined by a much larger no of variables and variable having values more than just 'yes' or 'no'.
- The no. of possible distributions, routes, fraud rules, or transportation plans might be so large that to examine all possibilities would take many centuries at the best, an exhaustive search that relies on computing power is clearly not the answer.

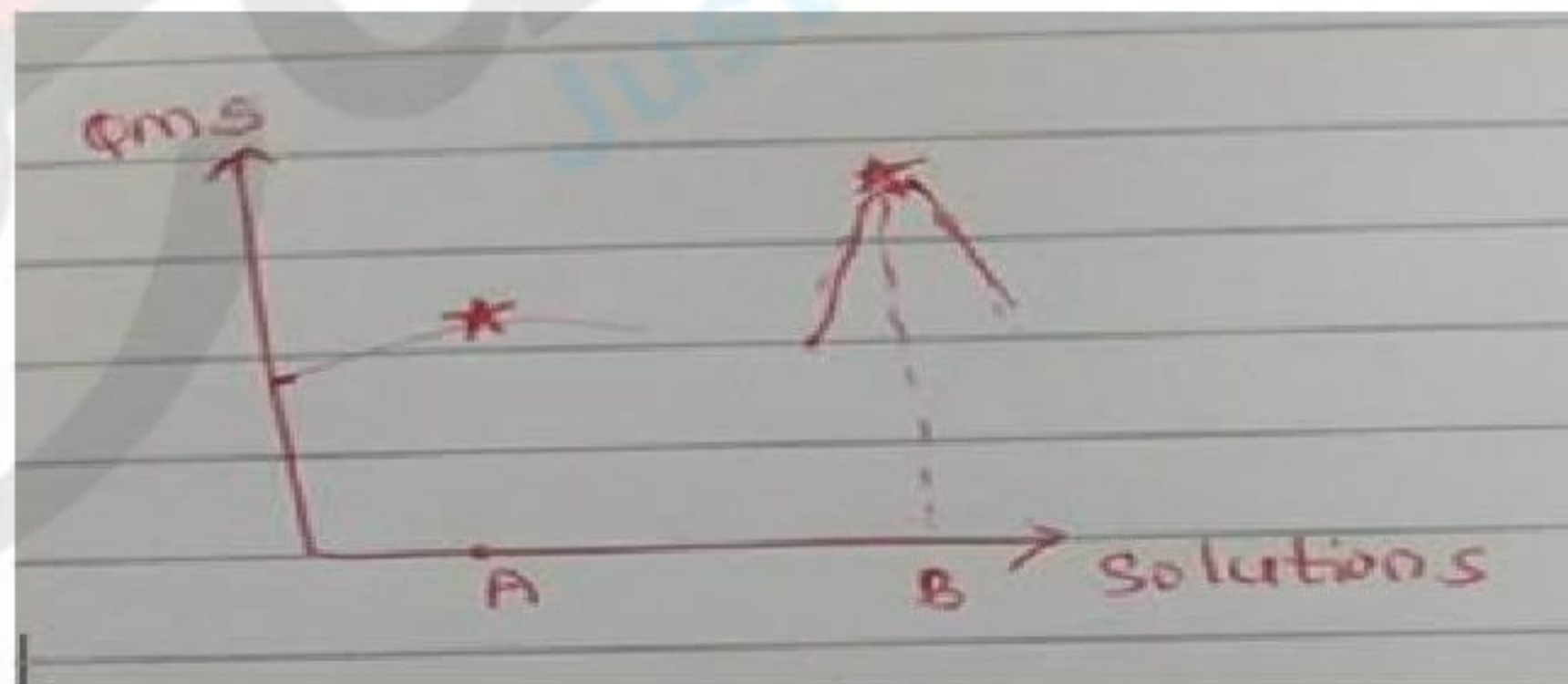
Time changing environment:

- A real world business problems are set in time changing environment. It is important to address the time factor explicitly.
- Eg. Travelling Salesman Problem with many trucks.
- If this problem is carefully analyzed and set of delivery routes found , the quality of these routes will be affected by many cyclical factors(such as rush hour & weekend traffic , weather and road condition etc) and by random events (such as labor strikes or delivery trucks accidents).
- Problem influenced by many environmental factors any solution to static snapshots of this problem proves useless.

- Case 1) Considering implementation of a solution A or B. Solution B is better than solution A has higher quality measure score(QMS)



- Case 2) Solution A sits on relatively flat peak and solution B sits on a very narrow peak. If we modify the solution B for any reason then quality of solution B will deteriorate very quickly. In this condition solution A is better than solution B and solution A is more stable and less risky.



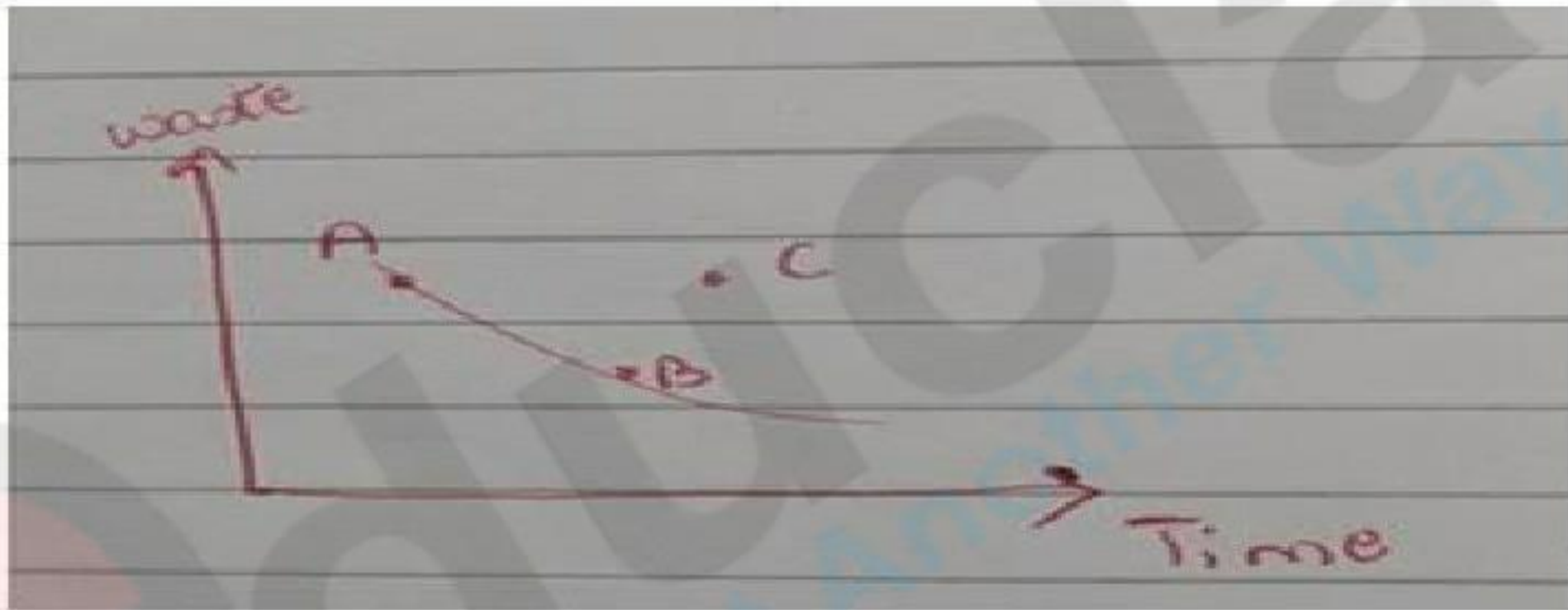
Problem Specific Constraints:

- All real world business problem have constraints of some sort and if a particular solution does not satisfy these constraints then we cannot consider this solution.
- There are two types of constraints
 - **Hard constraints:** A feasible solution cannot violate
 - **Soft constraints:** Represent requirement not mandatory
- For e.g. Travelling salesman problem: constraints include capacity limits, delivery time windows, maximum driving time, etc.
- Some of hard constraints are not transporting chemicals and food together on the same truck
- Soft constraint eg. Personnel preference
- It is necessary to assert the relative importance to each soft constraint by assigning numeric weights to it. While solving problem, these weights are used to calculate quality measure score for each possible solution.

Multi-objective problems:

- Real world business problem may have more than one objective.
- Eg. Objective may include minimization of production time and minimization of material waste etc both are: **production time is inversely proportional to material waste.**
- Multiple-objective problems pose the challenge of defining the quality of a solution in terms of several parameters(possibly conflicting).
- Solutions on the multiple-objective problem is classified into dominated and non-dominated solution.
- **Solution can be dominated if feasible solution exists**
- Atleast good with respect to every objective
- Strictly better with respect to atleast one objective

- Case 1) Solution is dominated because of solution A is as good as solution C on waste and time dimension



- **Case 2)** Solution not dominated by any other feasible solution called non-dominant solution. dominated by A,D,B,H one waste better on all objectives. We may assess the relative impact of each objective by assigning numeric weights or by imposing a ranking for all objectives and selecting solution following this rank.

Or

Select main objective and convert other objective into constraints.

