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Experiment No. 5

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**Aim** – To implement a given problem using greedy approach.

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**Details** – The greedy method is one of the strategies to solve the optimization problems. An optimization problem is a problem that demands either maximum or minimum results. The main function of this approach is that the decision is taken on the basis of the currently available information without worrying about the effect of the current decision in future. It determines the feasible solution that may or may not be optimal. The feasible solution is a subset that satisfies the given criteria. The optimal solution is the solution which is the best and the most favourable solution in the subset. In the case of feasible, if more than one solution satisfies the given criteria then those solutions will be considered as the feasible, whereas the optimal solution is the best solution among all the solutions. The components of the greedy algorithm are:

- **Candidate set:** A solution that is created from the set is known as a candidate set.
- **Selection function:** This function is used to choose the candidate or subset which can be added in the solution.
- **Feasibility function:** A function that is used to determine whether the candidate or subset can be used to contribute to the solution or not.
- **Objective function:** A function is used to assign the value to the solution or the partial solution.
- **Solution function:** This function is used to intimate whether the complete function has been reached or not.

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**Problem Definition & Assumptions –** Suppose S = { $a_1$, $a_2$ ,..., $a_n$ } is the set of n activities. The activities share a resource which can be used by only one activity at a time, e.g., Tennis Court, Lecture Hall, etc. Each activity ai has a start time $s_i$ and a finish time $f_i$, where 0 ≤ $s_i$ < $f_i$< ∞. If selected, activity ai takes place during the half-open time interval [$s_i$ , $f_i$ ). Activities ai and aj are compatible if the intervals [$s_i$ , $f_i$ ). and [$s_j$ , $f_j$ ) do not overlap (i.e., $a_i$ and $a_j$ are compatible if $s_i \geq f_j$ or $s_j \geq f_i$). The activity-selection problem is to select a maximum-size subset of mutually compatible activities.

1) $S_{i,j}$ = Problem instance with an input of set of activities $a_k$ such that $a_k$ start after "$a_i$ finishes" and $a_k$ finishes before "$a_j$ starts".
2) $A_{i,j}$ = Maximum number of set of activities which are not overlapping when the input to the problem instance $S_{i,j}$ .
3) C[0..n+1][0..n+1] = Two dimension matrix of maximum number of non-overlapping activities of all possible activities $a_i$ ,..., $a_j$ sorted in ascending order of their finish times.
4) Act[0..n+1][0..n+1] = Actual non-overlapping activities of all possible activities $a_i$ ,..., $a_j$ sorted in ascending order of their finish times.

Youtube Video Links for Understanding Activity Selection using Dynamic Programming and Greedy Approach:

1. Activity Selection using Dynamic Programming – https://www.youtube.com/watch?v=7UbMn9DlKxA
   https://www.youtube.com/watch?v=I9D1zdKm8Nk
2. Algorithm of Activity Selection using Dynamic Programming - https://walkccc.me/CLRS/Chap16/16.1/
3. Activity Selection using Greedy Approach - https://www.youtube.com/watch?v=U4UoR9vq238
   https://www.youtube.com/watch?v=jD_D-b6t_eU

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**Input –**

**1)** All $s_i$ and $f_j$ for i=1 to 100 are randomly generated in the range of (1,100).

**Output –**

1) The count for maximum number of non-overlapping activities out of n=100 activities and actual activities which are not non-overlapping using both greedy and dynamic programming approach.

**Submission –**

1) C/C++ source file of implementation
2) Optimal solutions $A_{i,j}$ and times taken for two combinations of Dynamic Programming and Greedy approach
3) One page report of Exp. 5 (PDF file)