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Solve each problem by hand using dynamic programming. Before solving each problem, answer the following:

- What are the *stages* in this problem?
- What defines the *states* within each stage?
- For each stage-state combination, what are the *decisions* you are choosing between?
- What is the *interpretation of the value function* for this particular problem? For example, in the knapsack problem we solved in class, was interpreted as "the maximum value that can be derived by packing some subset of items t through 5 into a knapsack capable of holding i"

Next, solve the problem by hand using dynamic programming, showing your work. State the optimal solution and its value.

Q1: Food Truck Tactics

Joe's Grease truck is allowed to operate in three locations (which we will just call "1", "2", and "3"). Joe parks the truck and sells food in a single location for a day and then has the option to move to another location overnight. His moving costs between locations are

Location	1	2	3
1	$ -	$ 50	$ 100
2	$ 50	$ -	$ 75
3	$ 100	$ 75	$ -

Joe estimates his profit from selling food in each location on each day as follows:

	Day			
Location	1	2	3	4
1	$ 180	$ 210	$ 200	$ 250
2	$ 170	$ 205	$ 230	$ 240
3	$ 260	$ 220	$ 190	$ 255

For example, if operates in location 2 on day 3, he expects to make a $230 profit selling food.

Joe has already committed to spend day 1 in location 3, and he must be back at location 1 after day 4 (either by already being there on day 4, or moving there overnight after day 4). Within these constraints, how can Joe maximize his overall profits (total profit from selling food, minus total moving costs) for days 1 through 4?

Q2: Allocating Patrol Cars

(Problem 4 on page 242 of the textbook.) The estimated number of crimes per week in each of a city's three police precincts depends on the number of patrol cars assigned to each precinct, as shown in the table below (for example, if you assign 2 cars to precinct 1, you estimate that there will be 7 crimes there). Five patrol cars are available.

Precinct	Number of Cars Assigned					
	0	1	2	3	4	5
1	14	10	7	4	1	0
2	25	19	16	14	12	11
3	20	14	11	8	6	5

Your objective value is to minimize the total estimated number of weekly crimes in the city. What is the minimum possible number of crimes attainable? You may find that there is more than one possible car deployment pattern attaining the minimum number of crimes – if so, please list all of them.

Hint: the states should be set up similarly to the knapsack problem we solved in class.

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