Travelling Artist

An artist has the possibility to visit a number of different exhibitions in different cities over the next four days. Based on her experience, she has estimated the probabilities of sales at each exhibition, given that she attends the exhibition for a day. Each of her paintings sells for $500. She also knows how much it costs to travel between exhibitions and from her home to each of the exhibitions. She can only attend each exhibition once.

The data for sales and travel costs are given below. (You can download these in Python from Blackboard.)

$E\text{Sales}_i = \sum_{k=0,1,2} k \times \text{sales}_{ik}$

Exhibition	Probability of Paintings Sold		
	0	1	2
A	0.3	0.4	0.3
B	0.2	0.5	0.3
C	0.2	0.7	0.1
D	0.3	0.5	0.2
E	0.3	0.6	0.1
F	0.4	0.3	0.3
G	0.0	0.3	0.7
H	0.1	0.1	0.8

sales_{ik} = prob of selling k paintings in city i

	A	B	C	D	E	F	G	H
Home	143	108	118	121	88	121	57	92
A		35	63	108	228	182	73	162
B			45	86	193	165	42	129
C				46	190	203	73	105
D					172	224	98	71
E						174	160	108
F							129	212
G								117

c_{ij} = cost from i to j

a) The artist wants to maximize her expected profit from a tour of four exhibitions. What path should she take?

Stages: t days

State: S cities we've already visited
i where we are

Actions: j next city to go to

Value function:

$V_t(S,i)$ = max expected profit from

remaining tour if we have been gone for t days and are in city i having visited cities S.

$\rightarrow \quad V_4(S,i) = -c_{i\,\text{Home}}$

We want $V_0(\phi, \text{Home})$

$\rightarrow V_t(S,i) = \max_{j \in \text{Cities} \setminus S} \{500 \times \text{ESales}_j - c_{ij} + V_{t+1}(S \cup \{j\}, j)\}$

Part (b)

$V'_t(S,i,p)$ = max expected profit from remaining tour if we have been gone for t days and are in city i having visited cities S with p paintings remaining

$V'_4(S,i,p) = -c_{i\,\text{Home}}$

$V'_t(S,i,0) = -c_{i\,\text{Home}}$

$V'_t(S,i,p) = \max_{j \in \text{Cities} \setminus S} \{ c_{ij} \sum_{k \in \{0,1,2,3\}} \text{sales}_{jk} \cdot (500 \times \min(k,p) + V'_{t+1}(S \cup \{j\}, j, p - \min(k,p)))$