Maisie's Department Store
MDP Example

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Problem Description

The manager of Maisie's Dept. Store has to decide how much advertising copy to place in the local Sunday newspaper; in particular, he can choose either light (L) or heavy (H) coverage. He classifies weekly sales into 3 categories: Average (A), Above Average (AA), and Below Average (BA), and believes that the current week's sales depend on both the previous week's sales and the advertising level.

Light advertising coverage costs 100, and Heavy coverage costs 300. The weekly return from sales (excluding advertising costs) are

AA) above average: 1200
A) average: 1000
BA) below average: 900

We wish to find an advertising strategy that maximizes the average weekly net return (including advertising costs).

Cost Matrix

of states: 3
# of actions: 2

k	name	1	2	3
1	Light	-1100	-900	-700
2	Heavy	-900	-700	-500

(Rows ~ actions, Columns ~ states)

(minimizing the negative of the expected profit)

Transition Probabilities

Action: Light

from \ to	1	2	3
1	0.2	0.5	0.3
2	0	0.6	0.4
3	0	0.3	0.7

Action: Heavy

from \ to	1	2	3
1	0.6	0.3	0.1
2	0.4	0.5	0.1
3	0.2	0.7	0.1

LP Tableau

Maisie's Dept. Store

k:	1	2	1	2	1	2	RHS
i:	1	1	2	2	3	3	
Min	-1100	-900	-900	-700	-700	-500	
	0.8	0.4	0	-0.4	0	-0.2	0
	-0.5	-0.3	0.4	0.5	-0.3	-0.7	0
	1	1	1	1	1	1	1

i~state, k~action

Iteration 0

Policy: (Cost= -775)

	State	Action	P{i}
1	AA: above average	2 Heavy	0.475
2	A: average	2 Heavy	0.425
3	BA: below average	2 Heavy	0.1

Iteration 0

Basic: * * *

k:	1	2	1	2	1	2	
i:	1	1	2	2	3	3	rhs
Min	-50	0	-25	0	0	0	775
	1.55	1	0.575	0	0.4	0	0.475
	-0.35	0	0.725	1	0.2	0	0.425
	-0.2	0	-0.3	0	0.4	1	0.1

i~state, k~action

Iteration 1

Policy: (Cost= -790.323)

	State	Action	P{i}
1	AA: above average	1 Light	0.306452
2	A: average	2 Heavy	0.532258
3	BA: below average	2 Heavy	0.16129

Iteration 1

Basic: ✱ ✱ ✱

k:	1	2	1	2	1	2	
i:	1	1	2	2	3	3	rhs
Min	0	32.2581	-6.45161	0	12.9032	0	790.323
	1	0.645161	0.370968	0	0.258065	0	0.306452
	0	0.225806	0.854839	1	0.290323	0	0.532258
	0	0.129032	-0.225806	0	0.451613	1	0.16129

i~state, k~action

Iteration 2

Policy: (Cost= -794.34)

	State	Action	P{i}
1	AA: above average	1 Light	0.0754717
2	A: average	1 Light	0.622642
3	BA: below average	2 Heavy	0.301887

Iteration 2

Basic: ✱ ✱ ✱

k:	1	2	1	2	1	2	
i:	1	1	2	2	3	3	rhs
Min	0	33.9623	0	7.54717	15.0943	0	794.34
	1	0.54717	0	-0.433962	0.132075	0	0.0754717
	0	0.264151	1	1.16981	0.339623	0	0.622642
	0	0.188679	0	0.264151	0.528302	1	0.301887

i~state, k~action