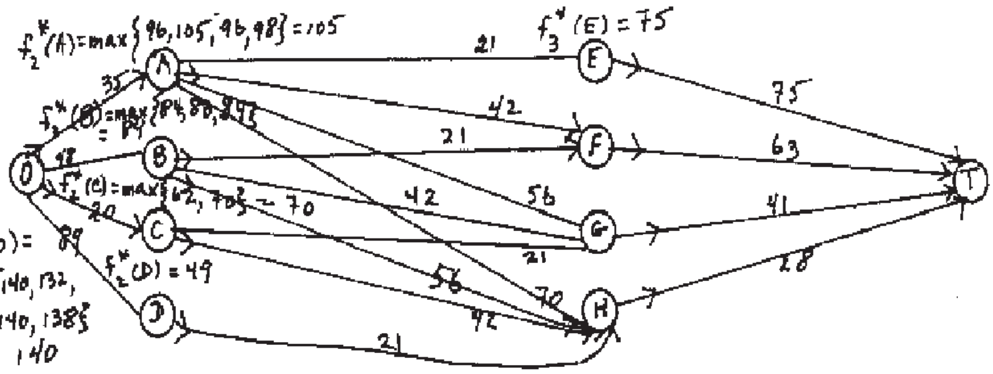
Solution Keys to Chapter 11 Problems

11.2-2(a)



Optimal routes: O-A-F-T and 140 is the corresponding sales income.
O-C-H-T

Optimal Solution:

	Region 1	2	3
number of Salespeople	1	2	3
	3	2	1

(b) Stage n — region n
state s_n — number of salespeople remaining to be allocated at stage n
x_n — number of salespeople allocated to region n
$c_n(x_n)$ — increase in sales in region n if x_n salespeople are allocated to it

INTERACTIVE DETERMINISTIC DYNAMIC PROGRAMMING ALGORITHM SOLUTION

Number of Stages = 3

Calculations:

S3	f3*(S3)	X3*
1	28	1
2	41	2
3	63	3
4	75	4

S2 \ X2	f2(S2, X2): 1	2	3	4	f2*(S2)	X2*
2	49	---	---	---	49	1
3	62	70	---	---	70	2
4	84	83	84	---	84	1,3
5	96	105	97	98	105	2

S1 \ X1	f1(S1, X1): 1	2	3	4	f1*(S1)	X1*
6	140	132	140	138	140	1,3

Optimal solution(s):

Optimal solution	X1*	X2*	X3*
1	1	2	3
2	3	2	1

11.2-3

a) stages: 5 "columns" in network

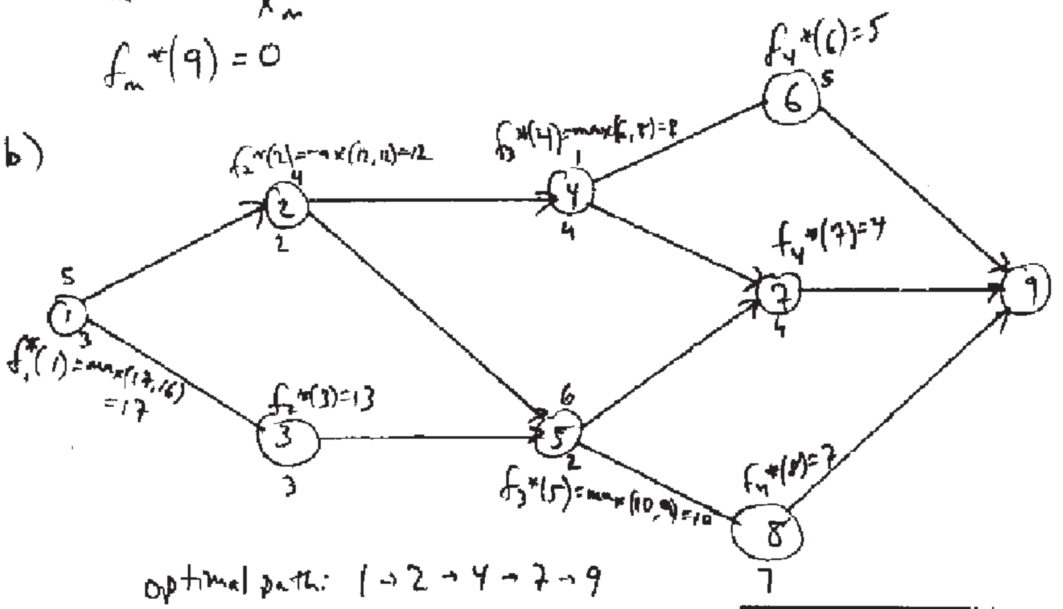
states: nodes of the network

let t_{ij} be times for activities, given:

$$f_m^*(s) = \min_{x_m} \left(t_{s,x_m} + f_{m+1}^*(x_m) \right)$$

$$f_m^*(9) = 0$$

b)



optimal path: $1 \to 2 \to 4 \to 7 \to 9$

or $1 \to 2 \to 5 \to 7 \to 9$

c) Interactive Deterministic Dynamic Programming Algorithm:

s_4	$f_4^*(s_4)$	x_4^*
1	5	1
2	4	1
3	7	1

s_3 \ x_3	$f_3(s_3,x_3)$ 1	2	$f_3^*(s_3)$	x_3^*
1	6	8	8	2
2	10	9	10	1

s_2 \ x_2	$f_2(s_2,x_2)$ 1	2	$f_2^*(s_2)$	x_2^*
1	12	12	12	1, 2
2	13	---	13	1

s_1 \ x_1	$f_1(s_1,x_1)$ 1	2	$f_1^*(s_1)$	x_1^*
1	17	16	17	1

Optimal Sol.	x_1^*	x_2^*	x_3^*	x_4^*
1	1	1	2	1
2	1	2	1	1

11.3-1

Let x_n be the number of crates allocated to store n.
Let $p_n(x_n)$ be the expected profit from allocating x_n crates to store n.
Let s_n be the number of crates remaining.
Then, $f_n^*(s_n) = \max_{0 \le x_n \le s_n} [p_n(x_n) + f_{n+1}^*(s_n - x_n)]$

Number of Stages = 3

Calculations:

S3	f3*(S3)	X3*
0	0	0
1	4	1
2	9	2
3	13	3
4	18	4
5	20	5

S2 \ X2	f2(S2, X2): 0	1	2	3	4	5	f2*(S2)	X2*
0	0	---	---	---	---	---	0	0
1	4	6	---	---	---	---	6	1
2	9	10	11	---	---	---	11	2
3	13	15	15	15	---	---	15	1,2,3
4	18	19	20	19	19	---	20	2
5	20	24	24	24	23	22	24	1,2,3

S1 \ X1	f1(S1, X1): 0	1	2	3	4	5	f1*(S1)	X1*
5	24	25	24	25	23	21	25	1,3

Optimal solution(s):

Optimal solution	X1*	X2*	X3*
1	1	2	2
2	3	2	0

11.3-5

Let x_n be the number of workers allocated to precinct n.

Let $p_n(x_n)$ be the increase in the number of votes if x_n workers are assigned to precinct n.

Let s_n be the number of workers remaining.

Then $f_n^*(s_n) = \max_{1 \le x_n \le s_n} [p_n(x_n) + f_{n+1}^*(s_n - x_n)]$.

INTERACTIVE DETERMINISTIC DYNAMIC PROGRAMMING ALGORITHM SOLUTION

Number of Stages = 4

Calculations:

S4	f4*(S4)	X4*
0	0	0
1	6	1
2	11	2
3	14	3
4	15	4
5	17	5
6	18	6

S3 \ X3	f3(S3, X3): 0	1	2	3	4	5	6	f3*(S3)	X3*
0	0	---	---	---	---	---	---	0	0
1	6	5	---	---	---	---	---	6	0
2	11	11	10	---	---	---	---	11	0,1
3	14	16	16	15	---	---	---	16	1,2
4	16	19	21	21	18	---	---	21	2,3
5	17	21	24	26	24	21	---	26	3
6	18	22	25	29	29	27	22	29	3,4

S2 \ X2	f2(S2, X2): 0	1	2	3	4	5	6	f2*(S2)	X2*
0	0	---	---	---	---	---	---	0	0
1	6	7	---	---	---	---	---	7	1
2	11	13	11	---	---	---	---	13	1
3	16	18	17	16	---	---	---	18	1
4	21	23	22	22	18	---	---	23	1
5	26	28	27	27	24	20	---	28	1
6	29	33	32	32	29	26	21	33	1

S1 \ X1	f1(S1, X1): 0	1	2	3	4	5	6	f1*(S1)	X1*
6	33	32	32	33	31	29	24	33	0,3

Optimal solution(s):

Optimal solution	Precinct 1 X1*	2 X2*	3 X3*	4 X4*
1	0	1	3	2
2	3	1	0	2
3	3	1	1	1

number of workers