

Pregunta #2 25ptos

Objetivo Programación Dinámica=> Número de Empleados

Una empresa dedicada a la fabricación de piezas de carro iniciará un nuevo proyecto, su Gerente de Recursos Humanos estima las necesidades de personal durante las próximas 11 semanas serán 6,9,6,11,8,7,4,2,8,3,7 trabajadores, respectivamente. La mano de obra en exceso que se conserve le costará \$550(C1) por trabajador semanalmente, y la nueva contratación en cualquier semana tendrá un costo fijo de \$225 y \$350 (C2). La duración del proyecto de acuerdo con la información que le presenta en la siguiente tabla, necesita su recomendación antes de iniciar el proyecto.

Semana	Fuerza Laboral	Rangos	bi
1	6		b1
2	9		b2
3	6		b3
4	11		b4
5	8		b5
6	7		b6
7	4		b7
8	2		b8
9	8		b9
10	3		b10
11	7		b11

- Rango
- Todas las tablas
- Decisión para el gerente, comparando las estimaciones y los resultados de su análisis
- Respuesta, con el costo

Semana	Fuerza Laboral	Rangos	bi
1	6	0	b1
2	9	6,7,8,9,10,11	b2
3	6	9	b3
4	11	6,7,8,9,10,11	b4
5	8	11	b5
6	7	8	b6
7	4	7,8	b7
8	2	9,5,6,7,8	b8
9	8	2,3,4,5,6,7,8	b9
10	3	8	b10
11	7	3,4,5,6,7,8	b11

Costo de exceso:  $C1(x_i - b_i) = C1 = 550$

Costo de contratación:  $C2(x_i - x_{i-1}) = 350$

Costo de Contratación: 225

## Etapas II:

$$b_i = 7 \rightarrow SSO(x_i - b_i) + [225 + 3SSO(x_i - x_{i-1})]$$

$(x_i - 1)$ $x_{10}$	$x_{11} = 7$ (require) $SSO(x_i - b_i) +$ $[225 + 3SSO(x_i - x_{i-1})]$	$f_{11}(x_{10})$	$x_{11}$
3	$SSO(7-7) + [225 + 3SSO(7-3)] = 1625$	1625	7
4	$SSO(7-7) + [225 + 3SSO(7-4)] = 1275$	1275	7
5	$SSO(7-7) + [225 + 3SSO(7-5)] = 925$	925	7
6	$SSO(7-7) + [225 + 3SSO(7-6)] = 575$	575	7
7	$SSO(7-7) + 0 + 0 = 0$	0	7

## Etapas Ioi:

$$b_i = 3 \rightarrow SSO(x_i - b_i) + [225 + 3SSO(x_i - x_{i-1})] + f_{11}(x_{10})$$

$(x_i - 1)$ $x_9$	$x_{10} = 3$	$x_{10} = 4$	$x_{10} = 5$	$x_{10} = 6$	$x_{10} = 7$	$f_{10}(x_9)$	$x_{10}^*$
0	$SSO(3-3) + 0 + 1625 = 1625$	$SSO(4-3) + 0 + 1275 = 1825$	$SSO(5-3) + 0 + 925 = 2025$	$SSO(6-3) + 0 + 575 = 2225$	$SSO(7-3) + 0 + 0 = 2200$	1625	3

Etapas 9:

$$b_i = 8 \rightarrow 550(x_i - b_i) + [225 + 350(x_i - x_{i-1})] + f_{10}(x_9)$$

$(x_i - 1)$

$x_8$	$x_9 = 8$	$f_9(x_8)$	$x^*_9$
2	$550(8-8) + [225 + 350(8-2) + 1625] = 3950$	3950	8
3	$550(8-8) + [225 + 350(8-3) + 1625] = 3600$	3600	8
4	$550(8-8) + [225 + 350(8-4) + 1625] = 3250$	3250	8
5	$550(8-8) + [225 + 350(8-5) + 1625] = 2900$	2900	8
6	$550(8-8) + [225 + 350(8-6) + 1625] = 2550$	2550	8
7	$550(8-8) + [225 + 350(8-7) + 1625] = 2200$	2200	8
8	$550(8-8) + 0 + 0 + 1625 = 1625$	1625	8

## Etapas 8 :

$$b_i = 2 \rightarrow 550(x_i - b_i) + [225 + 350(x_i - x_{i-1})] + f_9(x_8)$$

Como la tabla es muy grande las columnas  $f_8(x_7)$  y  $x_8^*$  se haran aparte

$(x_i - 1)$

$x_7$	$x_8 = 2$	$x_8 = 3$	$x_8 = 4$	$x_8 = 5$	$x_8 = 6$	$x_8 = 7$	$x_8 = 8$
4	$550(2-2) + 0 + 3950 = 3950$	$550(3-2) + 0 + 3600 = 4150$	$550(4-2) + 0 + 3250 = 4350$	$1650 + [225 + 350 \cdot 1] + 2900 = 5125$	$2200 + [225 + 350 \cdot 2] + 2550 = 5675$	$2750 + [225 + 350 \cdot 3] + 2200 = 6225$	$3300 + [225 + 350 \cdot 4] + 1625 = 6550$
5	$550(2-2) + 0 + 3950 = 3950$	$550(3-2) + 0 + 3600 = 4150$	$550(4-2) + 0 + 3250 = 4350$	$550(5-2) + 0 + 2900 = 4550$	$2200 + [225 + 350 \cdot 1] + 2550 = 5325$	$2750 + [225 + 350 \cdot 2] + 2200 = 5875$	$3300 + [225 + 350 \cdot 3] + 1625 = 6200$
6	$550(2-2) + 0 + 3950 = 3950$	$550(3-2) + 0 + 3600 = 4150$	$550(4-2) + 0 + 3250 = 4350$	$550(5-2) + 0 + 2900 = 4550$	$550(6-2) + 0 + 2550 = 4750$	$2750 + [225 + 350 \cdot 1] + 2200 = 5525$	$3300 + [225 + 350 \cdot 2] + 1625 = 5850$
7	$550(2-2) + 0 + 3950 = 3950$	$550(3-2) + 0 + 3600 = 4150$	$550(4-2) + 0 + 3250 = 4350$	$550(5-2) + 0 + 2900 = 4550$	$550(6-2) + 0 + 2550 = 4750$	$550(7-2) + 0 + 2200 = 4950$	$3300 + [225 + 350 \cdot 1] + 1625 = 5500$
8	$550(2-2) + 0 + 3950 = 3950$	$550(3-2) + 0 + 3600 = 4150$	$550(4-2) + 0 + 3250 = 4350$	$550(5-2) + 0 + 2900 = 4550$	$550(6-2) + 0 + 2550 = 4750$	$550(7-2) + 0 + 2200 = 4950$	$550(8-2) + 0 + 1625 = 4925$

$f_8(x_7)$	$x_8^*$
3950	2
3950	2
3950	2
3950	2
3950	2

Etapa 7 :

$$G_i = 7 \rightarrow 550(x_i - b_i) + [225 + 350(x_i - x_{i-1})] + f_8(x_7)$$

$(x_{i-1})$

$x_6$	$x_7 = 4$	$x_7 = 5$	$x_7 = 6$	$x_7 = 7$	$x_7 = 8$	$f_7(x_6)$	$x^*_7$
7	$550(7-4) + 0 + 3950 = 3950$	$550(5-4) + 0 + 3950 = 4500$	$550(6-4) + 0 + 3950 = 5050$	$550(7-4) + 0 + 3950 = 5600$	$2200 + [225 + 350 \cdot 1] + 3950 = 6725$	3950	7
8	$550(8-4) + 0 + 3950 = 3950$	$550(5-4) + 0 + 3950 = 4500$	$550(6-4) + 0 + 3950 = 5050$	$550(7-4) + 0 + 3950 = 5600$	$550(8-4) + 0 + 3950 = 6150$	3950	7

Etapa 6 :

$$G_i = 7 \rightarrow 550(x_i - b_i) + [225 + 350(x_i - x_{i-1})] + f_7(x_6)$$

$(x_{i-1})$

$x_5$	$x_6 = 7$	$x_6 = 8$	$f_6(x_5)$	$x^*_6$
0	$550(7-7) + 0 + 3950 = 3950$	$550(8-7) + 0 + 3950 = 4500$	3950	7

Etapa 5 :

$$G_i = 8 \rightarrow 550(x_i - b_i) + [225 + 350(x_i - x_{i-1})] + f_6(x_5)$$

$(x_{i-1})$

$x_4$	$x_5 = 8$	$f_5(x_4)$	$x^*_5$
11	$550(8-8) + 0 + 3950 = 3950$	3950	8

Etapă 4:

$$b_i = 11 \rightarrow 550(x_i - b_i) + [225 + 350(x_i - x_{i-1})] + f_5(x_4)$$

$(x_i - 1)$

$x_3$	$x_4 = 11$	$f_4(x_3)$	$x^*_4$
6	$550(11-11) + [225 + 350(11-6)]$ $+ 3950 = 5925$	5925	11
7	$550(11-11) + [225 + 350(11-7)]$ $+ 3950 = 5575$	5575	11
8	$550(11-11) + [225 + 350(11-8)]$ $+ 3950 = 5225$	5225	11
9	$550(11-11) + [225 + 350(11-9)]$ $+ 3950 = 4875$	4875	11
10	$550(11-11) + [225 + 350(11-10)]$ $+ 3950 = 4525$	4525	11
11	$550(11-11) + 0 + 0$ $+ 3950 = 3950$	3950	11

### Etapa 3 :

$$G_i = 6 \rightarrow 550(x_i - b_i) + [225 + 350(x_i - x_{i-1})] + f_4(x_3)$$

Como la tabla es muy grande las columnas  $f_3(x_2)$  y  $x^*_3$  se haran aparte

$(x_i - 1)$

$x_2$	$x_3 = 6$	$x_3 = 7$	$x_3 = 8$	$x_3 = 9$	$x_3 = 10$	$x_3 = 11$
9	$550(6-6) + 0 + 5925 = 5925$	$550(7-6) + 0 + 5575 = 6125$	$550(8-6) + 0 + 5225 = 6325$	$550(9-6) + 0 + 4875 = 6525$	$2200 + [225 + 350.1] + 4525 = 7300$	$2750 + [225 + 350.2] + 3950 = 7625$
10	$550(6-6) + 0 + 5925 = 5925$	$550(7-6) + 0 + 5575 = 6125$	$550(8-6) + 0 + 5225 = 6325$	$550(9-6) + 0 + 4875 = 6525$	$550(10-6) + 0 + 4525 = 6725$	$2750 + [225 + 350.1] + 3950 = 7275$
11	$550(6-6) + 0 + 5925 = 5925$	$550(7-6) + 0 + 5575 = 6125$	$550(8-6) + 0 + 5225 = 6325$	$550(9-6) + 0 + 4875 = 6525$	$550(10-6) + 0 + 4525 = 6725$	$550(11-6) + 0 + 3950 = 6700$

$f_3(x_2)$	$x^*_3$
5925	6
5925	6
5925	6

Etapas 2 :

$$G_i = 9 \rightarrow 550(x_i - b_i) + [225 + 350(x_i - x_{i-1})] + f_3(x_2)$$

$(x_i - 1)$

$x_1$	$x_2 = 9$	$x_2 = 10$	$x_2 = 11$	$f_2(x_1)$	$x^*_2$
6	$550(9-9) + [225 + 350 \cdot 3] + 5925$ $= 7200$	$550(10-9) + [225 + 350 \cdot 4] + 5925$ $= 8100$	$550(11-9) + [225 + 350 \cdot 5] + 5925$ $= 9025$	7200	9
7	$550(9-9) + [225 + 350 \cdot 2] + 5925$ $= 6850$	$550(10-9) + [225 + 350 \cdot 3] + 5925$ $= 7750$	$550(11-9) + [225 + 350 \cdot 4] + 5925$ $= 8650$	6850	9
8	$550(9-9) + [225 + 350 \cdot 1] + 5925$ $= 6500$	$550(10-9) + [225 + 350 \cdot 2] + 5925$ $= 7400$	$550(11-9) + [225 + 350 \cdot 3] + 5925$ $= 8300$	6500	9
9	$550(9-9) + 0 + 5925$ $= 5925$	$550(10-9) + [225 + 350 \cdot 1] + 5925$ $= 7050$	$550(11-9) + [225 + 350 \cdot 2] + 5925$ $= 7950$	5925	9
10	$550(9-9) + 0 + 5925$ $= 5925$	$550(10-9) + 0 + 5925$ $= 6475$	$550(11-9) + [225 + 350 \cdot 1] + 5925$ $= 7600$	5925	9
11	$550(9-9) + 0 + 5925$ $= 5925$	$550(10-9) + 0 + 5925$ $= 6475$	$550(11-9) + 0 + 5925$ $= 7025$	5925	9



Etapas I :

$$G_i = S \rightarrow 550(x_i - b_i) + [225 + 350(x_i - x_{i-1})] + f_2(x_i)$$

Como la tabla es muy grande las columnas  $f_1(x_0)$  y  $x^*_1$  se haran aparte

$(x_i - 1)$

$x_0$	$x_1 = 6$	$x_1 = 7$	$x_1 = 8$	$x_1 = 9$	$x_1 = 10$	$x_1 = 11$
○	$0 + [225 + 350 \cdot 6] + 7200$ $= 9525$	$550 + [225 + 350 \cdot 7] + 6850$ $= 10075$	$1100 + [225 + 350 \cdot 8] + 6500$ $= 10625$	$1650 + [225 + 350 \cdot 9] + 5925$ $= 10950$	$2200 + [225 + 350 \cdot 10] + 5925$ $= 11850$	$2750 + [225 + 350 \cdot 11] + 5925$ $= 12750$

$f_1(x_0)$	$x^*_1$
9525	6

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Semana	Fuerza laboral	Modelo estimacion
1	6	6 Contrata 6
2	9	9 Contrata 3
3	6	6 despide 3
4	11	11 Contrata 5
5	8	8 despide 3
6	7	7 despide 1
7	4	4 despide 3
8	2	2 despide 2
9	8	8 Contrata 6
10	3	3 despide 5
11	7	7 Contrata 4

Costo total: 9525