HD·EDUCATION

BADM 模考 Solution

HD·EDU教案

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2018_BADM_Semester 2 Solution

Q1:

(1) X_1 = the number of acre of land growing soybean

X_2 = ... growing corn

Maximize the total revenue or $Z = (9\times60)X_1 + (2\times220)X_2 = 540X_1 + 440X_2$

Constraints: $X_1 + X_2 \le 120$ (total acre of land)

$2X_1 + 3X_2 \le 350$ (labor)

$40X_1 + 30X_2 \le 3800$ (machine time)

X_1 and $X_2 \ge 0$ (non-negativity)

(2) $X_1 = 20$, $X_2 = 100$ → 根据 machine time 的限制条件推导出

$Z = 540\times20 + 440\times100 = \$54,800$

(3) $2X_1 + 3X_2 = 2\times20 + 3\times100 = 340$ units, $350 - 340 = 10$ units left.

(4) Upper level: $440 + 100 = 540$

Lower level: $440 - 35 = 405$

When the price of corn is increased by $1 per bushel, the objective coefficient will increase to $(2+1)\times220 = 660$ ~~not~~ higher than upper level. Hence, the optimal solution ~~won't~~ will change.

(5) Upper level: $540 + 46.7 = 586.7$

Lower level: $540 - 35 = 505$

回答格式同第四小题, $8.5\times60 = 510$, still within the range of $(505, 586.7)$, won't change

(6) The range is $(3700, 4800)$, Shadow price is 10.

The revenue will increase $(4000 - 3800)\times10 = \$2,000$

(7) The range is ~~$(140-25, 140+1.67)$~~ 120 120 $(95, 121.67) = (115, 141.67)$, shadow price is 140.

If sale 10 acres of land, Z will decrease $10\times140 = \$1400 < \$2,000$. Should make the sale.

Q2:

(i) X_{ij} = the units of specific memory card i produced in specific city j.

i=1, M-R12 j=1, Taiwan

i=2, M-R20 j=2, Germany.

i=3, M-R36

Minimize the costs or $Z = \underbrace{0.93X_{11} + 0.99X_{12} + 0.97X_{21} + 1.08X_{22} + 1.29X_{31} + 1.19X_{32}}_{\text{production costs}} + \underbrace{0.22(X_{11}+X_{21}+X_{31})}_{\text{Shipping costs to Taiwan}} + \underbrace{0.12(X_{12}+X_{22}+X_{32})}_{\text{Shipping costs to Germany}}$

Constraints:

$X_{11} + X_{21} \le 195,000$

$X_{12} + X_{22} \le 170,000$

$X_{31} \le 85,000$

$X_{32} \le 115,000$

} Capacity Limitations.

$X_{11} + X_{12} = 300,000$

$X_{21} + X_{22} = 150,000$

$X_{31} + X_{32} = 190,000$

} Quantity requirements.

$X_{ij} \ge 0$ and integer ★ 说什么一定为整数，此题为 IP Model.

(ii) X_i = the amount of portion of funds allocated to specific investments i.

i=1, Stocks

i=2, bonds

i=3, mutual funds

i=4, cash.

Maximize the annual return or $Z = 0.1X_1 + 0.03X_2 + 0.04X_3 + 0.01X_4$

$X_1 + X_2 + X_3 + X_4 = 1$ ★ 比例之和为 1

$X_1 \le 0.75$

$X_3 \ge X_2$

$X_4 \le 0.3$

$X_4 \ge 0.1$

$0.8X_1 + 0.2X_2 + 0.3X_3 \le 0.4$

$X_i \ge 0$ to all $i = 1, 2, 3, 4$ ★ IP Model 的灵魂尾巴千万别忘 !!!

Q3:

(i) $x_i = \begin{cases} 1, & \text{if the location is selected} \\ 0, & \text{otherwise} \end{cases}$

Minimize the # of locations or $Z = x_1 + x_2 + x_3 + x_4 + x_5 + x_6 + x_7$

Constraints: $x_1 + x_2 + x_3 + x_7 \geq 1$

$x_2 + x_4 \geq 1$

$x_3 + x_5 \geq 1$

$x_4 + x_5 + x_6 \geq 1$

$x_1 + x_2 + x_3 + x_4 + x_6 + x_7 \geq 1$

$x_5 + x_6 + x_7 \geq 1$

$x_1 + x_2 + x_7 \geq 1$

$x_i = 0$ or 1, for all i $(1, 2, 3, 4, 5, 6, 7)$

★ Bineary IP Model 灵魂所在!!!

(ii) 存草稿纸中自己试着刷题时尽量画 Matric !!!

x_{ij} = the number of products shipped from warehouse i to boutique j.

$y_i = \begin{cases} 1, & \text{if the warehouse } i \text{ is selected} \\ 0, & \text{otherwise.} \end{cases}$

$i=1$, Boxhill
$i=2$, Blockbun.
$i=3$, Mitcham
$i=4$, Ringwood
$i=5$, Belgrave

$j=1$, Chadstone
$j=2$, CBD
$j=3$, Highpoint
$j=4$, Northland.

Minimize the costs or $Z = 56x_{11} + 21x_{12} + 32x_{13} + 65x_{14}$
$+ 18x_{21} + 46x_{22} + 7x_{23} + 35x_{24}$
$+ 12x_{31} + 71x_{32} + 41x_{33} + 52x_{34}$
$+ 30x_{41} + 24x_{42} + 61x_{43} + 28x_{44}$
$+ 45x_{51} + 50x_{52} + 26x_{53} + 31x_{54}$

Shipping costs.

$+ 2{,}100{,}000y_1 + 850{,}000y_2 + 1{,}800{,}000y_3 + 1{,}100{,}000y_4 + 900{,}000y_5$

annual fixed costs.

⚠漏掉的constraints

y1+y2+y3+y4+y5 <= 3

y1+y2 <=1

Constraints:

$x_{11} + x_{12} + x_{13} + x_{14} - 13000y_1 \leq 0$
$x_{21} + x_{22} + x_{23} + x_{24} - 18{,}000y_2 \leq 0$
$x_{31} + x_{32} + x_{33} + x_{34} - 14{,}000y_3 \leq 0.$
$x_{41} + x_{42} + x_{43} + x_{44} - 10{,}000y_4 \leq 0.$
$x_{51} + x_{52} + x_{53} + x_{54} - 16{,}000y_5 \leq 0.$

Annual Capacity

$x_{11} + x_{21} + x_{31} + x_{41} + x_{51} = 6000$
$x_{12} + x_{22} + x_{32} + x_{42} + x_{52} = 14{,}000$
$x_{13} + x_{23} + x_{33} + x_{43} + x_{53} = 8{,}000$
$x_{14} + x_{24} + x_{34} + x_{54} + x_{44} = 10{,}000$

Annual Demand

★ $x_{ij} \geq 0$ and Integer for all i and j.
$y_i = 0$ or 1, for all i.

Q4:

(i).

	S_1	S_2	S_3
d_1	$-1-(-2)=1$	$3-3=0$	$9-9=0$
d_2	0	$3-2=1$	$9-5=4$.

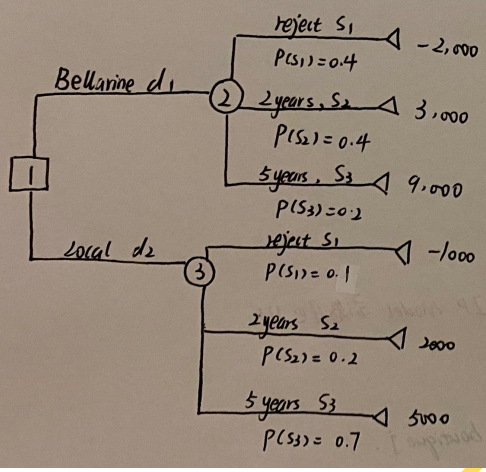
Maximum Regret

d_1	1
d_2	4

$R = \min_i [\max_j (R_{ij})] = 1.$

Choose Bellarine Fruits.

(ii)



$EV(d_1) = -2000 \times 0.4 + 3000 \times 0.4 + 9000 \times 0.2 = \$2200$

$EV(d_2) = -1000 \times 0.1 + 2000 \times 0.2 + 5000 \times 0.7 = \$3800$

$EV(d_2) - EV(d_1) = 3800 - 2200 = \$1600$

Daniel Harrison should choose Local Melrose Farm.

(iii)

Prior Probabilities	Conditional Probabilities	Joint Probabilities	Posterior Probabilities
$P(S_1)=0.4$	$P(F \mid S_1)=0.2$	$P(F \cap S_1)=0.08$	$P(S_1 \mid F)=0.17$
$P(S_2)=0.4$	$P(F \mid S_2)=0.6$	$P(F \cap S_2)=0.24$	$P(S_2 \mid F)=0.5$
$P(S_3)=0.2$	$P(F \mid S_3)=0.8$	$P(F \cap S_3)=0.16$	$P(S_3 \mid F)=0.33$
	$P(U \mid S_1)=0.8$	$P(F)=0.48$	$P(S_1 \mid U)=0.62$
	$P(U \mid S_2)=0.4$	$P(U \cap S_1)=0.32$	$P(S_2 \mid U)=0.31$
	$P(U \mid S_3)=0.2$	$P(U \cap S_2)=0.16$	$P(S_3 \mid U)=0.07$
		$P(U \cap S_3)=0.04$	
		$P(U)=0.52$	

$EV_6 = -2000 \times 0.17 + 3000 \times 0.5 + 9000 \times 0.33 = \$4130$

$EV_7 = -2000 \times 0.62 + 3000 \times 0.31 + 9000 \times 0.07 = \$380$

$EV(do) = 0.48 \times EV_6 + 0.52 \times EV_7 = \$2180$

The expected value for conducting the review is \$21810

If the review is favourable, the expected value is \$4130

If the review is unfavourable, the expected value is \$380

$EV_8 = \$2200$

$EV_9 = \$3800$

$EV_9 - EV(do) = 3800 - 2180 = \$1620$

Daniel should choose Local Farm after receiving the review from LRC, the reason is that the expected value of choosing local farm is higher than choosing Bellavine.

(v)

Payoff	Probabilities
9000	0.20
3000	0.40
-2000	0.40 (There is 40% probability Daniel will loss \$2000)

Q5:

(i) S = Sydney M = Melbourne

$P(X_S \geq 250) = P(Z \geq \frac{250-200}{40}) = 1 - P(Z \leq 1.25) = 1 - 0.8944 = 0.1056 = 10.56\%$

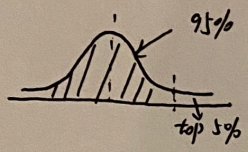
$P(X_m \geq 250) = P(Z \geq \frac{250-170}{30}) = 1 - P(Z \leq 2.67) = 1 - 0.9962 = 0.0038 = 0.38\%$.

(ii) $P(X_S \leq 190) = P(Z \leq -0.25) = 40.13\%$

$P(X_m \leq 190) = P(Z \leq 0.67) = 74.86\%$

$0.4013 \times 0.7486 = 0.3004 = 30.04\%$

(iii) $Z = 1.64$



$1.64 = \frac{X-170}{30}$

$X = \$219.2$

(iv). $\hat{y} = 195512.62 + 3.32X_1 + 26909.68X_2 - 1037.38X_3$

(V). $X_1 = 55{,}000$, $X_2 = 5$, $X_3 = 30$

$\hat{y} = 48{,}539.62$

(VI). $\hat{y}' = 56453.62$, the higher annual salary the higher loan

(Vii). $R^2 = 0.89$

The overall fit of the model is good. 89% of the variability in loan amount can be explained by the linear relationship between salary, work experience and age.

multipule

(Viii).