Assignment 4

torsdag 21. oktober 2021 19:00

9.1

- The objective function: $\text{profit} = 100k \cdot P_1 + 150k \cdot P_2 + 35k \cdot P_3 + 75k \cdot P_4 + 125k \cdot P_5 + 60k \cdot P_6$

- The binary var: $P_1, P_2, P_3, P_4, P_5, P_6$

- The constraints: $P_1 + P_2 = 1$ $\quad P_1 + P_3 \leq 1$

  $P_5 \cdot P_6 \neq 1$

First year expenditure $\leq 450\,000 \geq 300\,000\, P_1 + 100k \cdot P_2 + 50k \cdot P_4 + 50k \cdot P_5 + 100k \cdot P_6$

Second year expenditure $\leq 400\,000 \geq 300k \cdot P_2 + 200k \cdot P_3 + 100k \cdot P_4 + 300k \cdot P_5 + 200k \cdot P_6$

Engineering hours $\leq 10\,000 \geq 4000 \cdot P_1 + 7000 \cdot P_2 + 2000 \cdot P_3 + 6000 \cdot P_4 + 3000 \cdot P_5 + 600 \cdot P_6$

9.2

Objective function: Minimize cost = Fixed costs + $g_{1P_1} \cdot 5 + g_{1P_2} \cdot 5 + g_{2P_1} \cdot 3 + g_{2P_2} \cdot 3 + g_{3P_1} \cdot 8 + g_{3P_2} \cdot 8$

Fixed costs $= (g_{1P_1} \cdot \bar{g}_{1P_2} + \bar{g}_{1P_1} g_{1P_2}) \cdot 2800 + (g_{2P_1} \cdot \bar{g}_{2P_2} + \bar{g}_{2P_1} \cdot g_{2P_2}) \cdot 2000 + (g_{3P_1} \cdot \bar{g}_{3P_2} + \bar{g}_{3P_1} \cdot g_{3P_2}) \cdot 1900$

Binary Var: $g_{1P_1}, g_{2P_1}, g_{3P_1}, g_{1P_2}, g_{2P_2}, g_{3P_2}$

Constraints:
- $1900 \cdot g_{1P_1} + 1700 \cdot g_{2P_1} + 2900 \cdot g_{3P_1} \geq 2500$
- $1900 \cdot g_{1P_2} + 1700 \cdot g_{2P_2} + 2900 \cdot g_{3P_2} \geq 3500$

9.3

Objective: Minimize cost $= 280 \cdot g_{11} + 230 \cdot g_{12} + 188 \cdot g_{13} + 153 \cdot g_{14} + 135 \cdot g_{15}$
$+ 650 \cdot g_{21} + 538 \cdot g_{22} + 445 \cdot g_{23} + 367 \cdot g_{24} + 300 \cdot g_{25}$
$+ 700 \cdot g_{31} + 771 \cdot g_{32} + 640 \cdot g_{33} + 530 \cdot g_{34} + 430 \cdot g_{35}$

Binary Var: $g_{11}, g_{12}, g_{13}, g_{14}, g_{15}, g_{21}, g_{22}, g_{23}$
$g_{24}, g_{25}, g_{31}, g_{32}, g_{33}, g_{34}, g_{35}$

Constraints:
- year $1 \leq 780 \geq 700 + 10 \cdot g_{11} + 50 \cdot g_{21} + 100 \cdot g_{31}$
- year $2 \leq 860 \geq$ year $1 + 10 \cdot g_{12} + 50 \cdot g_{22} + 100 \cdot g_{32}$
- year $3 \leq 950 \geq$ year $2 + 10 \cdot g_{13} + 50 g_{23} + 100 \cdot g_{33}$
- year $4 \leq 1060 \geq$ year $3 + 10 \cdot g_{14} + 50 g_{24} + 100 \cdot g_{34}$
- year $5 \leq 1180 \geq$ year $4 + 10 \cdot g_{15} + 50 g_{25} + 100 \cdot g_{35}$