

TEMA B

x_i : #monili tipo $i \in \{A, B, C\}$ prodotti
 y_j : #secoli di lunghezza $j \in \{1, 2\}$
 w : se acquisto almeno 0,8 kg di lupetto 1, 0 altrimenti
 z_i : 1 se modulo mobile $i \in \{A, B, C\}$, 0 altrimenti
 t : #brevetati acquistati
 s : 1 se vende ≥ 150 tipo B
 $70y_1 + 50y_2 + 0,1t \leq 100$ BUDGET
 $\max 450x_A + 600x_B + 400x_C - 7000y_1 - 5000y_2 - 7000(2z_A + 2z_B + z_C) - 100t + 350x_B$
 $s.t. y_1 \geq 0,5; y_1 \leq 1,5; y_2 \geq 0,8; y_2 \leq 2$
 $3x_A + 3x_B + 5x_C \leq (0,4y_1 + 0,1y_2) \cdot 1000$
 $2x_A + x_B + 3x_C \leq (0,1y_1 + 0,5y_2) \cdot 1000$
 $x_A + x_B + 2x_C \leq (0,2y_1 + 0,3y_2) \cdot 1000$
 $2x_A + x_B \leq t$
 $x_A \leq 200 \quad x_B \leq 200 \quad x_C \leq 200 \quad t \leq 500$
 $x_A \leq Mz_A \quad x_B \leq Mz_B \quad x_C \leq Mz_C$
 $2z_A + z_B \leq 1$
 $y_2 \leq Mw \quad y_1 \geq 0,8w$
 $\bar{x}_B(x_B)$: monili B venduti entro (o fuori) 150
 $\bar{x}_B \leq 150 \quad \bar{x}_B \geq 150s \quad x'_B \leq Ms \quad x'_B \leq 50$
 $x_i \in \mathbb{Z}, y_j \in \mathbb{R}_+, z_i \in \{0,1\}, s \in \{0,1\}, t \in \mathbb{Z}_+, w \in \{0,1\} \quad \bar{x}_B, x'_B \in \mathbb{Z}_+$

2 min $-4x_1 - 3x_2 - x_3$ ($x_2 = -x_3$)
 $s.t. 2x_1 + x_2 - x_3 + x_4 = 2$
 $-x_1 - 2x_3 + x_5 = 1$
 $x_1 - 2x_2 + x_3 + x_6 = 1$
 $x_1, x_2, x_3, x_4, x_5, x_6 \geq 0$

	x_1	x_2	x_3	x_4	x_5	x_6	z	b
x_4	-4	-3	-1	0	0	0	-1	0
x_5	-1	0	-2	0	1	0	0	1
x_6	1	-2	1	0	0	1	0	1
	0	-1	-3	2	0	0	-1	$4+4R_1$
x_1	1	$\frac{1}{2}$	$-\frac{1}{2}$	$\frac{1}{2}$	0	0	0	$1+2$
x_5	0	$\frac{1}{2}$	$-\frac{5}{2}$	$\frac{1}{2}$	1	0	0	$2+R_1$
x_6	0	$-\frac{5}{2}$	$\frac{3}{2}$	$-\frac{1}{2}$	0	1	0	$0-R_1$
	2	0	-4	3	0	0	-1	$6+R_1$
x_2	2	1	-1	1	0	0	0	$2+2$
x_5	-1	0	-2	0	1	0	0	$1-R_1$
x_6	5	0	-1	2	0	1	0	$5+5R_1$

4 ENUNCIATO. AMMISS. PRINCIPALI.
 $\max 2u_1 + 3u_2 + 2u_4$
 $s.t. -2u_1 + 3u_2 + 8u_4 = 3$
 $u_1 + u_2 + u_3 - u_4 \leq -5$
 $-u_1 + u_3 + 2u_4 \geq 0$
 $u_1, u_2, u_3 \geq 0 \quad u_4 \leq 0$

SISTEMA

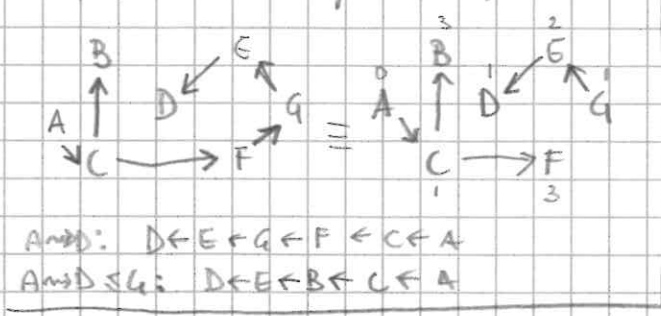
$$\begin{cases} -2u_1 + 3u_2 + 8u_4 = 3 & (A3) \\ u_1 + u_2 + u_3 - u_4 = -5 & (CCP1) \\ u_2 = 0 & (CCP2) \\ u_3 = 0 & (CCP3) \end{cases}$$

$-2x_1 + x_2 - x_3 = 2$ (A.P.)
 $3x_1 + x_2 > 0 \Rightarrow u_2 = 0$
 $x_2 + x_3 < 3 \Rightarrow u_3 = 0$
 $8x_1 - x_2 + 2x_3 = -2 \Rightarrow$
 $u_1 = \frac{37}{6}, u_2 = 0, u_3 = 0, u_4 = -\frac{7}{6}$
 $1v \text{ pc } 2v \text{ pc } 3v \frac{37}{6} - \frac{14}{6} > 0 \Rightarrow$
 $\Rightarrow$ OTTIMA!

5 a) $[x_6, x_2, x_4]$ non ottimale ($\exists$ pivot non deg.)
 b) x_7 !
 c) entrare x_2 , esce x_4 , $x_6 = 0 = x_4$
 d) $x_2, x_6 | x_2, x_4 | x_3, x_4 | x_5, x_2$
 e) sì, entra x_1 , esce $x_4 \rightarrow [x_6, x_7, x_1]$ $z_{\max} = 100 + 0 \cdot \frac{37}{6}$

PROBLEMA ILLIMITATO: (DUALE INAMMISS.)

	A	B	C	D	E	F	G	Accum.
1	0	0	0	0	0	0	0	A-B
2	0	4	1	0	0	0	0	BC
3	0	3	1	5	3	0	0	BDEF
4	0	3	1	4	2	3	1	DEG
5	0	3	1	3	2	3	1	DE
6	0	3	1	1	2	3	1	D



$A \rightarrow B$: $D \leftarrow E \leftarrow G \leftarrow F \leftarrow C \leftarrow A$
 $A \rightarrow D \rightarrow C$: $D \leftarrow E \leftarrow B \leftarrow C \leftarrow A$

6 a) $(12, 16)$ | $(17, 12)$ | $(13, 2)$ | $(13, 2)$
 scegli $(12, 16)$ (o anche $(13, 2)$)
 b) $[12, 14]$
 c) P_2, P_3, P_4, P_5 chiudo P_5, P_6
 d) P_3
 e) $UB_2 \leq 12$ (≥ 10) [$OP_2 \geq 13 \Rightarrow$ infeasibile]