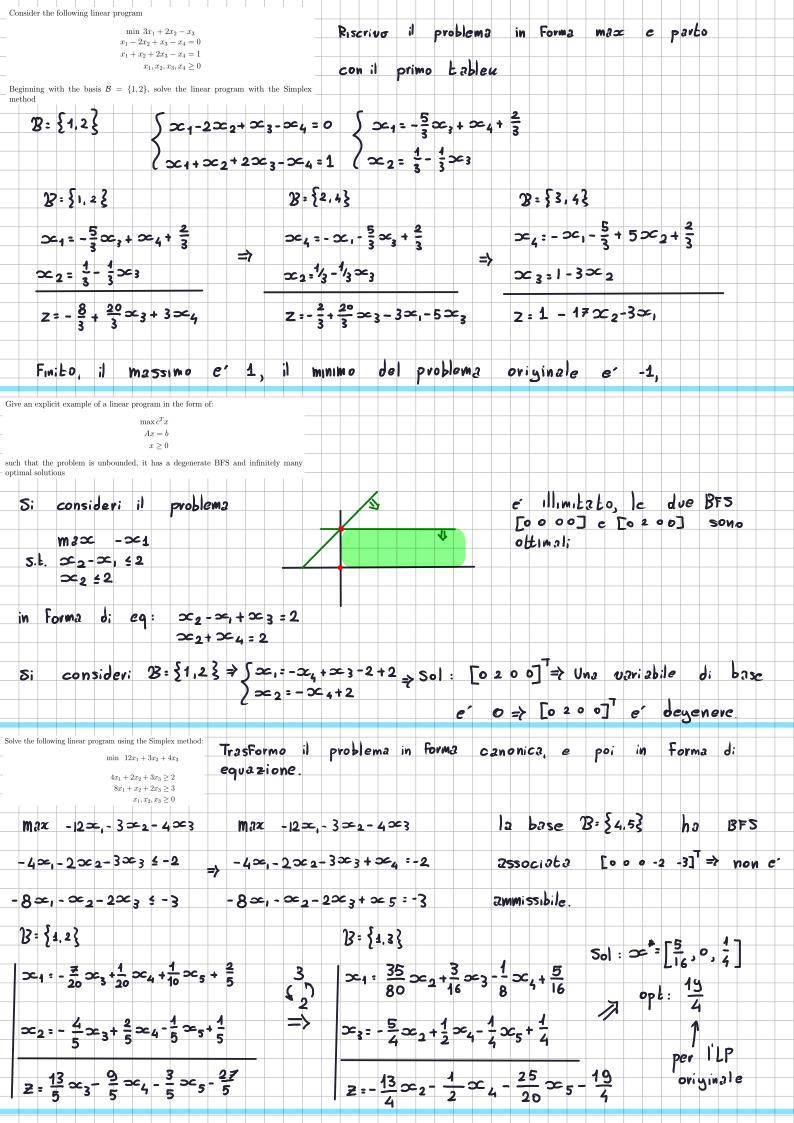
Gli esercizi presentati in questo documento, esposti negli appunti di Optimization di Simone Bianco, sono tratti da esercizi del libro, e da esercizi che il professore ha presentato in classe durante il corso delle lezioni. Consider the following linear pr La matrice dei vincoli $\max x_1 + 2x_2 - 3x_3 + 7x_0$ $x_1 + 2x_2 + 2x_3 + x_4 = 3$ 4,5,6 Sono lin. indip. $x_1 + 2x_2 + 7x_3 + x_5 = 3$ Le colonne $2x_1 + 4x_2 + 7x_3 + x_6 = 6$ quindi c e' una BFS associata $x_1, x_2, x_3, x_4, x_5, x_6 \geq 0$ base Determine and justify which of the following vectors is a basic feasible solution (BFS): tale 2. $b = \begin{bmatrix} 1 & 0 & 0 & 2 & 2 & 4 \end{bmatrix}$ Given a general linear program in equational form let \overline{x} and \overline{y} be two optimal solutions to the problem. Prove or disprove the following 1. Any convex combination of \overline{x} and \overline{y} is also an optimal solution to the linear 2. There exists an optimal solution \overline{z} on the line through \overline{x} and \overline{y} which is also basic combinazione convessa d: due punti \vec{x}, \vec{y} e' il scymento $c^{\mathsf{T}} \overset{\sim}{\approx} = c^{\mathsf{T}} \overset{\sim}{\mathsf{y}} : \mathsf{X} \qquad \mathsf{Z} : \alpha \overset{\sim}{\approx} + (1 - \alpha) \overset{\sim}{\mathsf{y}}$ $C^Tz = C^T(\alpha x + (1-\alpha)y) = \alpha C^T \overline{x} + (1-\alpha)C^T \overline{y} = \alpha S + (1-\alpha)S = S \Rightarrow z$ sono BFS, ossia vertici poliedro, 2 e' falsa perche' del ž oqni (per definizione) di linea di Devtici e' vertice. punto Seymento non Consider the polyhedron $P = \{x \in \mathbb{R}^n \mid Ax \leq b, x \geq 0\}$ and let $v \in P$. Prove that vis a vertex of P if and only if there exists a vector c such that v is the unique optimal basic feasible solution to the linear program:] H= { x : c = a} vertice di P⇒ cTx < a Yx6P\ {v} e' oltimale Sol. max ctx => necessariamente di [<=]: U l'unic 2 Sol. BF5 บทล vertice Solve the following linear program using the Simplex method: Il problema in A: -1 1 -2 Forma matriciale $x_1 + 2x_2 + x_3 \le 8$ => In Forma di eq: A: -1 1 -2 0 1 b = [8 4]T 13= {4,5} base 8=34,55 x1+2 x2+ x3+ x4 = 8 $\infty_4 = 8 - \infty_1 - 2\infty_2 - \infty_3$ $\infty 5 : 4 + \infty_1 - \infty_2 + 2 \infty_3$ $-x_1+x_2-2x_2+x_5=4$ Z = 254+ 52-52 2: 224+ 22-22 => Per il 2 : {1,5} $\begin{cases} \infty_1 : 8 \\ \infty_5 : 12 \end{cases}$ Problema originale e' = [800] $\Rightarrow |a|$ Sol olt. x1=8-x1-2x2-x3 $x_5:4+x_4-x_2+2x_3$ $z : 16 - 2 \times 4 - 3 \times 2 - 3 \times 3$



Consider the standard form polyhedron $P = \{x \mid A \text{ matrix } A \text{ of dimensions } m \times n has linearly independent of the standard of the s$			
– solutions are non-degenerate. – Given $\overline{x} \in P$ such that \overline{x} has exactly m positive con	nponents:		
1. Show that \overline{x} is a BFS			
2. Show that the previous point is false if we remo	ve the non-degeneracy assumption		
Se = ha m compone	nti positive, e no	on ci sono	soluzioni degenere,
allor 3 B: {i : \$i >	o} e' la base di	∞, ed e' un	a BFS Solo Se
Az, che ha m color	nne, c' non sin	yolare, essendo	che il rango
delle righe di Ae	m, lo e' anche	quello di Azz=) le colonne di
Azz sono lin. Ind. =	PAB er non sing	ol ave.	
Se l'assunzione		degenere e	Falsa, hon si
puo affermare che	B= {i: \$i>0}	sia la bose di	∞.
Consider the following primal program: $\min \ c^T x$ $- Ax \geq b$	Il duale e sm	ax by Smin	-b ^T ¢
$x\geq 0$ 1. Form the dual program and state it as an equivalent minimization problem 2. Derive the conditions on A,b and c such that the dual is identical to the		[4	o self-dual se
meaning that the problem is self-dual 3. Give a concrete example of a primal program identical to its dual			ma∞ [1-1] ∞
$\left\{\infty: A\infty \ge b\right\} : \left\{\infty: A^{\top}\infty\right\}$	€ c } ⇒	Un'esempio e	: st [0-1] x 2 [-1]
[17]	-c} ===> 2A = AT		105=11
2 x : Ax ≥ b (= 3 x :- A x ≥	200		25.2
{∞: A∞≥b{ - }∞:-H∞=	200		∞ ≥0
Consider the following linear program:	Considero il	(min 32+1272	⇒ ≥0
Consider the following linear program: $\max \ 2x_1 + 16x_2 + 12x_3$ $2x_1 + x_2 - x_3 \leq 3$	Considero il problema duale:	1	→ ≥0
Consider the following linear program: $\max \ 2x_1 + 16x_2 + 12x_3$	Considero il	221-322 = 2	→ ≥0
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Essendo $\Rightarrow 1, \Rightarrow 3 \Rightarrow 0 \Rightarrow$ $\begin{pmatrix} 2\xi_1 - 3\xi_2 = 2 \\ \xi_1 + 8\xi_2 = 16 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix}$ $\begin{pmatrix} 2\xi_1 - 3\xi_2 = 2 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_2 = 12 \end{pmatrix} \Rightarrow \begin{pmatrix} 2\xi_1 \\ \xi_1 + \xi_$	Considero il problema duale: $= 2+3\frac{7}{2} \qquad \begin{cases} 2+3\frac{3}{2} + 2 + \frac{3}{2} + $	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	⇒ y* = [40 26] ^T
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