ASSIGNMENT 3 – SOLUTIONS

(a). With equality constraints

$$\max\ 3x_1 + 5x_2$$

such that
$$2x_1 + 3x_2 + x_3 = 12$$
$$3x_1 + 4x_2 - x_4 = 6$$
$$x_1, x_2, x_3, x_4 \geq 0$$

basic variables	basic solution	feasible	point on graph
x_1, x_2	$(-30, 24, 0, 0)$	no	$(-30, 24)$
x_1, x_3	$(2, 0, 8, 0)$	yes	$(2, 0)$.
x_1, x_4	$(6, 0, 0, 12)$	yes	$(6, 0)$.
x_2, x_3	$(0, 3/2, 15/2, 0)$	yes	$(0, 3/2)$
x_2, x_4	$(0, 4, 0, 10)$	yes	$(0, 4)$.
x_3, x_4	$(0, 0, 12, -6)$	no	$(0, 0)$.

(b) With equality constraints.

$$\max\ 3x_1 + 2x_2$$

such that
$$4x_1 + 3x_2 + x_3 = 12$$
$$3x_1 + 4x_2 + x_4 = 12$$
$$x_1, x_2, x_3, x_4 \geq 0$$

basic variables	basic solution	Feasible?	point on graph
(x_1, x_2).	$(12/7, 12/7, 0, 0)$	yes	$(12/7, 12/7)$
(x_1, x_3).	$(4, 0, -4, 0)$	no	$(4, 0)$
(x_1, x_4)	$(3, 0, 0, 3)$	yes	$(3, 0)$
(x_2, x_3)	$(0, 3, 3, 0)$	yes	$(0, 3)$
(x_2, x_4)	$(0, 4, 0, -4)$	no	$(0, 4)$.
(x_3, x_4)	$(0, 0, 12, 12)$	yes	$(0, 0)$.

(c) You could start by reducing it to a 2-D problem as we did in Assignment 2, or alternatively solve the problem as is. Marks will be given for either approach. I'm using the second one here.

$$\max\ 3x_1 + 2x_2 + x_3$$

such that
$$3x_1 + x_2 + x_3 = 4$$
$$3x_1 + x_2 + x_4 = 5$$
$$x_1 + 4x_2 + x_5 = 6.$$
$$x_1, x_2, x_3, x_4, x_5 \geq 0.$$

basic variables	basic solution	feasible?	point on graph
(x_1, x_2, x_3)	$(\frac{14}{11}, \frac{13}{11}, -1, 0, 0)$	no	$(\frac{14}{11}, \frac{13}{11}, -1)$.
(x_1, x_2, x_4)	$(\frac{10}{11}, \frac{14}{11}, 0, 1, 0)$.	yes	$(\frac{10}{11}, \frac{14}{11}, 0)$.
(x_1, x_2, x_5)	equations are inconsistent.		
(x_1, x_3, x_4)	$(6, 0, -14, -13, 0)$	no	$(6, 0, -14)$.
(x_1, x_3, x_5).	$(5/3, 9, -1, 0, 13/3)$	no	$(5/3, 0, 1)$.
(x_1, x_4, x_5)	$(4/3, 0, 0, 1, 14/3)$	yes	$(4/3, 0, 0)$.
(x_2, x_3, x_4).	$(0, 3/2, 5/2, 7/2, 0)$	yes	$(0, 3/2, 5/2)$.
(x_2, x_3, x_5)	$(0, 5, -1, 0, -14)$	no	$(0, 5, -1)$.
(x_2, x_4, x_5).	$(0, 4, 0, 1, -10)$	no	$(0, 4, 0)$.
(x_3, x_4, x_5)	$(0, 0, 4, 5, 6)$	yes	$(0, 0, 4)$.