MATH 1010 Assignment 2 Summer 14 Solutions

1. If the company sells x compact disc players per year, its revenue is $50x$. The yearly cost for manufacturing the x players is $900,000 + 35x$. Thus, the profit is

$$P(x) = 50x - (900,000 + 35x) = 15x - 900,000.$$

The company breaks even when profit is zero,
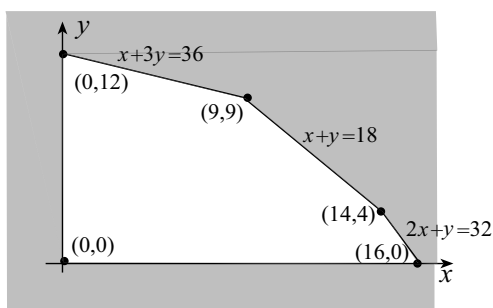
$$15x - 900,000 = 0$$
$$x = \frac{900,000}{15} = 60,000.$$

Hence, the company must sell at least 60,000 compact disc players to make a profit.

2. An equivalent system of constraints is

$$2x + y \le 32, \quad y + x \le 18, \quad x + 3y \le 36, \quad y \ge 0, \quad x \ge 0.$$

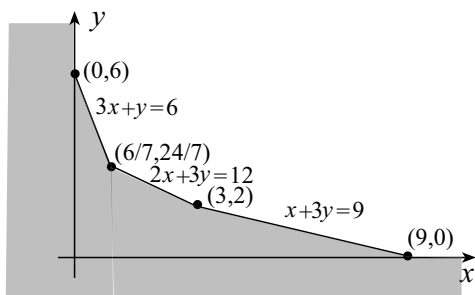The feasible set is shown in the figure below. From the table, we conclude that the largest value of f is 900.

Corner	$f = 80x + 70y - 500$
$(0,0)$	-500
$(0,12)$	340
$(9,9)$	850
$(14,4)$	900
$(16,0)$	780

3. An equivalent system of constraints is

$$2x + 3y \ge 12, \quad 3x + y \ge 6, \quad x + 3y \ge 9, \quad x \ge 0, \quad y \ge 0.$$

The feasible set is shown in the figure below. From the table, we conclude that the smallest value of f is 66.

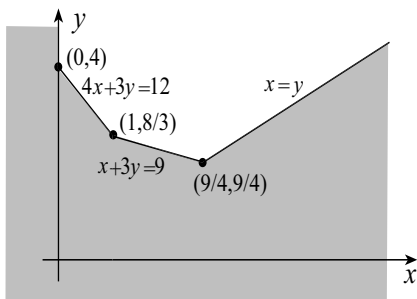| Corner	$f = 21x + 14y$
$(0,6)$	84
$(6/7, 24/7)$	66
$(3,2)$	91
$(9,0)$	189

4. Let x be the number of hours that she jogs (per week) and y be the number of hours that she cycles.

	Jogging	Cycling	Minimum
Number of hours/week	x	y	
Aerobic points/hour	12	9	36
Speed (mpr)	6	18	54 miles

The objective function is to minimze $f = x + y$. Constraints on the variables are:

$$12x + 9y \geq 36, \qquad 4x + 3y \geq 12,$$
$$6x + 18y \geq 54, \qquad x + 3y \geq 9,$$
$$y \geq x, \qquad\qquad y \geq x,$$
$$x \geq 0, \qquad\qquad x \geq 0,$$
$$y \geq 0, \qquad\qquad y \geq 0.$$

The feasible set is shown below. The table indicates that she should jog for 1 hour and cycle for 2 hours and 40 minutes.

Corner	$f = x + y$
$(0, 4)$	4
$(1, 8/3)$	$11/3$
$(9/4, 9/4)$	$9/2$