Assignment 1

Q1 (i) Express the desired goal as a linear programming problem in terms of variables X and Y.

Maximise: $60x + 50y$

subject to: $2x + 4y \leq 80$

$3x + 2y \leq 60$

$X \geq 0, y \geq 0$

(iv)

Maximise: $60x + 50y$

Subject to: $2x + 4y + z_1 = 0$

$3x + 2y + z_2 = 0$

$X \geq 0, y \geq 0, z_1, z_2 \geq 0$

Q3. (i) List the decision variables for the blending problem and formulate the selection of a schedule as a linear programming problem. Provide the coefficient matrices (A) for the standard and canonical forms of the problem.

Decision variables:

$X_{ij}$, i = A, B, j = 1,2,3

<u>Standard form:</u>

Maximise:

$Z = c'x$; $x=(x_{A1}, x_{A2}, x_{A3}, x_{B1}, x_{B2}, x_{B3})'$ ;$c=(5, 4, 3, 5, 4, 3)'$

Subject to:

$1x_{A1} + 1x_{A3} + 1x_{A3} + 0x_{B1} + 0x_{B2} + 0x_{B3} \leq 28$
$0x_{A1} + 0x_{A3} + 0x_{A3} + 1x_{B1} + 1x_{B2} + 1x_{B3} \leq 25$

$- 1x_{A1} + 0x_{A3} + 0x_{A3} + 0x_{B1} - 1x_{B2} + 0x_{B3} \leq -20$

$0x_{A1} - 1x_{A3} + 0x_{A3} + 0x_{B1} - 1x_{B2} + 0x_{B3} \leq -10$

$0x_{A1} + 0x_{A3} - 1x_{A3} + 0x_{B1} + 0x_{B2} -1x_{B3} \leq -14$

$1x_{A1} + 0x_{A3} - 0x_{A3} - 1x_{B1} + 0x_{B2} + 0x_{B3} \leq 0$

$0x_{A1} + 1x_{A3} + 0x_{A3} - 1x_{B1} + 0x_{B2} + 0x_{B3} \leq 0$

$0x_{A1} + 0x_{A3} - 1x_{A3} + 0x_{B1} + 0x_{B2} + 3x_{B3} \leq 0$

Canonical form:

Maximise:

$Z = c'x;\ x=(x_{A1}, x_{A2}, x_{A3}, x_{B1}, x_{B2}, x_{B3})';\ c=(5, 4, 3, 5, 4, 3)'$

Subject to:

$1x_{A1} + 1x_{A3} + 1x_{A3} + 0x_{B1} + 0x_{B2} + 0x_{B3} + 1x_1 = 28$
$0x_{A1} + 0x_{A3} + 0x_{A3} + 1x_{B1} + 1x_{B2} + 1x_{B3} + 1x_2 = 25$

$- 1x_{A1} + 0x_{A3} + 0x_{A3} + 0x_{B1} - 1x_{B2} + 0x_{B3} + 1x_3 = -20$

$0x_{A1} - 1x_{A3} + 0x_{A3} + 0x_{B1} - 1x_{B2} + 0x_{B3} + 1x_4 = -10$

$0x_{A1} + 0x_{A3} - 1x_{A3} + 0x_{B1} + 0x_{B2} - 1x_{B3} + 1x_5 = -14$

$1x_{A1} + 0x_{A3} - 0x_{A3} - 1x_{B1} + 0x_{B2} + 0x_{B3} + 1x_6 = 0$

$0x_{A1} + 1x_{A3} + 0x_{A3} - 1x_{B1} + 0x_{B2} + 0x_{B3} + 1x_7 = 0$

$0x_{A1} + 0x_{A3} - 1x_{A3} + 0x_{B1} + 0x_{B2} + 3x_{B3} + 1x_8 = 0$

Q4.(i) Write the problem in polar coordinates

Maximise: $z = (\sqrt{(x^2 + y^2)})(\cos(\tan^{-1}(y/x))) + (\sqrt{(x^2 + y^2)})(\sin(\tan^{-1}(y/x)))$

subject to: $\sqrt{((\sqrt{(x^2 + y^2)})\cos(\theta))^2 + (\sqrt{(x^2 + y^2)})\sin(\theta)^2)}$