Exercise 1: Simplex Method (2.5 pts).

Solution:

Answer to Q1:

	x1	x2	x3	x4	x5	
x2	0.50	1.00	-1.50	0.50	0.00	2.50
x5	1.50	0.00	-2.50	-0.50	1.00	4.50
obj	-4.25	0.00	-0.25	-0.25	0.00	-1.25

The optimal solution is

$x_1 = 0,$
$x_2 = 2.5,$
$x_3 = 0,$
$x_4 = 0,$
$x_5 = 4.5.$

Answer to Q2:

	x1	x2	x3	x4	x5	
x2	0.50	1.00	-1.50	0.50	0.00	2.50
x5	1.50	0.00	-2.50	-0.50	1.00	4.50
obj	-5.50	0.00	0.50	-0.50	0.00	-2.50

The infinite family of feasible solutions with unbounded objective value is given by

$x_1 = 0.0t + 0.0$
$x_2 = 1.5t + 2.5$
$x_3 = 1.0t + 0.0$
$x_4 = 0.0t + 0.0$
$x_5 = 2.5t + 4.5.$

Answer to Q3:

$\alpha = 11/3 = 3.66....$

Justification: If we repeat the calculations with the generic initial last row $[3 - 2\alpha, \alpha - 3, -1, 0, 0, 0]$ we see that, in the interval $[3.5, 4.0]$, the only positive entry is the second. After pivoting on it, the last row becomes $[-2.5\alpha + 4.5, 0, 1.5\alpha - 5.5, -0.5\alpha + 1.5, 0, -2.5\alpha + 7.5]$. In the interval $[3.5, 4.0]$, all these quantities are negative except $1.5\alpha - 5.5$, which is positive if and only if $\alpha > 5.5/1.5 = 11/3$.