The Carpenters Problem and Its Dual

Maximize 5 X1 + 3 X2
Subject to:
2 X1 + X2 ≤ 40 labor constraint
X1 + 2 X2 ≤ 50 material constraint
and both X1, X2 are non-negative.

Introducing Slakes/Surplus variables we have,

Maximize 5 X1 + 3 X2
Subject to:
2 X1 + X2 + S1 = 40
X1 + 2 X2 + S2 = 50
and both X1, X2, S1, S2 are non-negative.

The Final Simplex Tableau for the Primal is:

BVS	X1	X2	S1	S2	RHS
X1	1	0	2/3	-1/3	10
X2	0	1	-1/3	2/3	20
Cj	0	0	-7/3	-1/3	110

The Dual Problem for the Carpenter:

Minimize 40 U1 + 50 U2
Subject to:
2U1 + 1U2 ≥ 5 Net Income from a table
1U1 + 2U2 ≥ 3 Net Income from a chair
and U1, U2 are non-negative.

Introducing Slakes/Surplus variables we have,
Minimize 40 U1 + 50 U2
Subject to:
2U1 + 1U2 –S1 = 5
1U1 + 2U2 –S2 =3
and U1, U2, S1, S2 are non-negative.

The Final Simplex Tableau for the Dual is:

BVS	U1	U2	S1	S2	RHS
U2	0	1	1/3	-2/3	1/3
U1	1	0	-2/3	1/3	7/3
Cj	0	0	-10	-20	110