1 2010 MANG SCI PAPER 3 Q1 DAVID UEMBRECHT.

1a

Basis	value	A	B	C	S_1	S_2	S_3	
		2	3	4	0	0	0	
S_1	0	1	2	-1	1	0	0	50
S_2	0	2	1	3	0	1	0	130 = 43
S_3	0	1.5	1	2	0	0	1	40 = 20
Z_j		0	0	0	0	0	0	
$C_j - Z_j$		2	3	4	0	0	0	

C enters, S_3 exits $\begin{smallmatrix}0\\0\\1\end{smallmatrix}$

$r_3 \div 2$ $r_2 - 3r_3$ $r_1 + r_3$

Basis	value	A	B	C	S_1	S_2	S_3	
		2	3	4	0	0	0	
S_1	0	7/4	5/2	0	1	0	1/2	90 36
S_2	0	-1/4	-1/2	0	0	1	-1/2	10 -
C	4	3/4	1/2	1	0	0	1/2	20 = 40
Z_j		3	2	4	0	0	2	80
$C_j - Z_j$		-1	1	0	0	0	-2	

B enters, S_1 leaves want $\begin{smallmatrix}1\\0\\0\end{smallmatrix}$

$r_1 \times 2/5$ $r_2 + \frac{1}{2} r_1$ $r_3 - \frac{1}{2} r_1$

Basis	value	A	B	C	S_1	S_2	S_2	
		2	3	4	0	0	0	
B	3	7/10	1	0	2/5	0	1/5	36
S_2	0	-37/20	0	0	1/15	1	-2/5	28
C	4	2/5	0	1	-1/15	0	2/5	2
Z_j		37/10	3	4	2/5	0	11/5	116
$C_j - Z_j$		-1.7	0	0	-2/5	0	-11/5	

1 a ii. I would add in 4th variable D which will represent any units above 10 in A

Max $2A + 3B + 4C + 3.5D$

ST: $A + 2B - C + D \leq 50$

$2A + B + 3C + D \leq 130$

$1.5A - B + 2C + D \leq 40$

$D \geqslant A - 10$

B

		x_1	x_2	x_3	x_4	s_1	s_2	s_3	s_4	
basis	value	$1.8c_1$	1.5	2	1.2	0	0	0	0	
x_1	$18c_1$	1	0	0	$0.5c_1$	0	$0.4c_1$	$0.3c_1$	$-0.2c_1$	30
x_2	15	0	1	0	0.6	0	0.3	0.7	−0.3	24
x_3	2	0	0	1	−0.3	0	1	0.1	0.4	21
s_1	0	0	0	0	−2	1	0.2	−0.6	0.1	18
z_j		1.8	1.5	2	1.2	0	3.17	1.74	−0.01	132
$c_j - z_j$		0	0	0	0	0	−3.17	−1.74	0.01	

current Solution is: $x_1 = 30$ $x_2 = 24$, $x_3 = 21$, $s_1 = 18$

value is 132

Answer is optimal if: values in $c_j - z_j$ row are all negative, implying that optimal solution has been reached
- values on rhs are all positive

Sensitivity of coefficient of x_1.

$-0.5c_1 + 0.3 \leq 0$	$-0.4c_1 - 2.45 \leq 0$	$-0.3c_1 - 1.25 \leq 0$	$-0.2c_1 - 1.15 \geqslant 0$
$0.5c_1 \geqslant 0.3$	$c_1 \geqslant -6.125$	$c_1 \geqslant -25/6$	$c_1 \leq -5.75$.
$c_1 \geqslant 0.6$			

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We use the right hand side ranges to show us how much extra units of a constraint we are allowed to add or to subtract to keep the updated solution optimal.

To obtain this we ~~multiply~~ add solution column ~~add~~ Δs_1 and column for S_2 multiplied by ΔS_2 and ~~add~~ create an equality that they must be ≥ 0

c. Max $1100C + 500S - 50W - 300B$

ST:	$0.75C$	$+S$	$+W$		≤ 100	y_1
	$20C$	$+6S$	$+25W$		≤ 1200	y_2
	C		$-4W$	$-B$	≤ 0	y_3

rhs becomes objective function MIN $100y_1 + 1200y_2 + 0y_3$

$0.75y_1$	$+20y_2$	$+y_3$	$\leq$	1100
y_1	$+6y_2$		$\leq$	500
y_1	$+25y_2$	$-4y_3$	$\leq$	-50
		$-y_3$	$\leq$	-300

The solution is the same as per simplex solution above

Saya = 70.3704, WF = 7.4071 Cow = 24.6296

and value = 67407.4

Sheep land = $\frac{1}{12}$

man days = 1.5

4

Ball	Value	Cows	Soya	Wf	BWF	Sh	S_1	S_2	S_3	S_4
Ball	Value	1100	500	-50	-300	X	0	0	0	0
Soya	500	0	1	0	-0.05					
Wf	-50	0	0	1	0.191					
Cows.	1100	1	0	0	-0.273					
S_4	0	0	0	0						