Please fill in feedback questionnaive an QMplus!

Kecap quiz

An LP max $C^{T}Z$ subto $AZ = E, Z \ge 2$ is called _______ if, for every $k \ge 0$ there exists $Q = \sum Such$ that _____ $\ge k$

Suppose we apply simplex to above LP God final tablean is

What is the next step?

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	x_1	x_2	x_3	s_1	s_2	
s_1	-1	0	0	1	0	6
x_3	$\frac{3}{4}$	$\frac{1}{2}$	1	0	0	$\frac{3}{2}$
s_2	$\frac{1}{2}$	-3	0	0	1	3
-z	4	11	0	0	0	-12

	1					I
	x_1	x_2	x_3	s_1	s_2	
s_1	-1	0	0	1	0	6
x_2	$\frac{3}{2}$	1	2	0	0	3
s_2	5	0	6	0	1	12
-z	$-\frac{25}{2}$	0	-22	0	0	-45

Q: We found optimal solution for B with objective value O. (in phase 1).

what would it mean for A if instead

(i) (i) (i) had optimal solution whose dijective was not zero

- (ii) Br was infeasible
- (iii) Bi was unbounded

Â

Maximize $10x_1 + 15x_2 + 8x_3$ sub to $8x_1 + 6x_2 + 12x_3 + s_1 = 24$ $-4\chi_1 - 6\chi_2 - 6\chi_3 + S_2 = -6$ 621 + 422 + 823 = 12 x1, x2, x3, S1, S270.



 $\max -a_1 - q_2$

Sub to $8x_1 + 6x_2 + 12x_3 + 5_1 = 24$ $-4x_1 - 6x_2 - 6x_3 + 5_2 - a_1 = -6$ $6x_1 + 4x_2 + 8x_3 + 4a_2 = 12$ $x_1, x_2, 5_1, 5_2, a_1, a_2, 70$ Formal description of 2-phase Simplex

O Given LP transform into standard equation fam with slack variables just as before

(2)-If there is constraint with a slack variable s and b<0 say $q_1 z_1 + q_2 z_2 + \cdots + q_n z_n + s = b$ then replace with $q_1 z_1 + q_2 z_2 + \cdots + q_n z_n + s - a = b$ - If there is constraint with no slack variable say $q_1 z_1 + q_2 z_2 + \cdots + q_n z_n = b$

then replace with $q_1 x_1 + q_2 x_2 + \cdots + q_n x_n + a' = b$

Here a, a' are artificial variables with sign restriction a, a'zo Each replaced constraint gets a different artificial variable.

(3) Form initial tableau as before except - variables on the left If a constraint has an artificial variable, put it on

the left If a constraint has no artificial variable, put its slack variable on the left

(Recall variables listed on the left are the basic variables in our current basic Reasible Solution)

as before.

Bring tableau into <u>valid form</u> so that each ortificial variable has a single 1 and all other zeros in its column Do this as follows:

(4)

(a) Ignaring Rz and Rw Multiply raws by -1 where necessary so that each artificial variable has in its column (above fre live) a single 1 (rather than -1)
(b) Every row with an artificial variable on the left is added to Rw (to remove -1's in columns of artificial variables).



(5) Now apply standard simplex treating Rw as Cur objective.
(When clearing a column in a pivot, we also make sure we clear the column entry in Rz).
(6) (a) If far right entry of Rw is 0 then have found our starting basic feasible solution.
Delete Rw and columns of artificial variables.
Apply standard simplex to this tablean with Rz as objective. (We call this phase 2).

- (6) (a) If far right entry of Rw is O then have found Our storting basic feasible solution. Delete Rw and columns of artificial variables. Apply standard simplex to this tablean with Rz as objective. (We call this phase 2).
 - (b) If for right entry ct Rw is > O then Our original LP is infeasible.

Note It could happen in 6(a) that for right entry of Rw is zero, but some artificial voriable is basic (i.e. appears on left). Then we connot immediately proceed to apply standard simplex. Small, relatively easy step to deal with this but omitted here (and non-examinable). Want you to get the main ideas and not be distracted by pathological situations. Does Simplex algorithm always terminate? - Sometimes a pivot operation does not change far right column, i.e. Sometimes BFS stays unchanged and objective does not improve.

trample on next page.

when we apply the rules of simplex it can happen that we end up with exactly the same tablean we saw earlier! This is called cycling. Texample next page)
By adjusting the "tie-break" rules, we can avoid this and ensure simplex always terminates. We omit the details here.

	x_1	x_2	s_1	s_2	s_3	s_4	s_5	s_6	
s_1	-2	1	1	0	0	0	0	0	1
s_2	$-\frac{3}{2}$	1	0	1	0	0	0	0	3
s_3	-1	1	0	0	1	0	0	0	5
s_4	$-\frac{3}{4}$	1	0	0	0	1	0	0	6
s_5	0	1	0	0	0	0	1	0	10
s_6	1	0	0	0	0	0	0	1	10
-z	0	1	0	0	0	0	0	0	0
	I								I
	$ x_1 $	x_2	s_1	s_2	s_3	s_4	s_5	s_6	
x_2	-2	1	1	0	0	0	0	0	1
s_2	$\frac{1}{2}$	0	-1	1	0	0	0	0	2
s_3	1	0	-1	0	1	0	0	0	4
s_4	$\frac{5}{4}$	0	-1	0	0	1	0	0	5
s_5	2	0	-1	0	0	0	1	0	9
s_6	1	0	0	0	0	0	0	1	10
-z	2	0	-1	0	0	0	0	0	-1
	x_1	x_2	s_1	s_2	s_3	s_4	s_5	s_6	
x_2	0	1	-3	4	0	0	0	0	9
x_1	1	0	-2	2	0	0	0	0	4
s_3	0	0	1	-2	1	0	0	0	0
s_4	0	0	$\frac{3}{2}$	$-\frac{5}{2}$	0	1	0	0	0
s_5	0	0	3	-4^{-4}	0	0	1	0	1
s_6	0	0	2	-2	0	0	0	1	6
-z	0	0	3	-4	0	0	0	0	-9
	x_1	$\frac{x_2}{1}$	$\frac{s_1}{0}$	<i>s</i> ₂	s_3	$\frac{s_4}{0}$	s ₅	s ₆	0
x_2	$\begin{array}{c} x_1 \\ 0 \\ 1 \end{array}$	$\frac{x_2}{1}$	$\frac{s_1}{0}$	$\frac{s_2}{-2}$	s ₃ 3	$\frac{s_4}{0}$	$\frac{s_5}{0}$	$\frac{s_6}{0}$	9
$\begin{array}{c} x_2 \\ x_1 \\ e_1 \end{array}$		$\frac{x_2}{1}$	$\frac{s_1}{0}$	$\frac{s_2}{-2}$	s ₃ 3 2	$\frac{s_4}{0}$	$\frac{s_5}{0}$	s ₆ 0 0	9 4
$\begin{array}{c} x_2 \\ x_1 \\ s_1 \\ s_4 \end{array}$			$\frac{s_1}{0}$ 0 1	s_2 -2 -2 -2 -2 1	$\frac{s_3}{3}$ 2 1 _ 3^2			s ₆ 0 0 0 0	9 4 0
x_2 x_1 s_1 s_4 s_5			$\frac{s_1}{0}$ 0 1 0 0	s_2 -2 -2 -2 $\frac{1}{2}$	$\frac{s_3}{3}$ 2 1 $-\frac{3}{2}$ -3		$ \frac{s_5}{0} 0 0 $	s ₆ 0 0 0 0 0 0	9 4 0 0
$\begin{array}{c} x_2 \\ x_1 \\ s_1 \\ s_4 \\ s_5 \\ s_6 \end{array}$			$ \frac{s_1}{0} \\ 0 \\ 1 \\ 0 \\ 0 \\ 0 \\ 0 0 $	s_2 -2 -2 -2 $\frac{1}{2}$ 2	$\frac{s_3}{3}$ 2 1 $-\frac{3}{2}$ -3 -2				9 4 0 1 6
$\begin{array}{c} x_2 \\ x_1 \\ s_1 \\ s_4 \\ s_5 \\ s_6 \\ \hline -z \end{array}$					$\frac{s_3}{3}$ 2 1 $-\frac{3}{2}$ -3 -2 -3			s ₆ 0 0 0 0 0 0 1 0	$9 \\ 4 \\ 0 \\ 1 \\ 6 \\ -9$
$\begin{array}{c} x_2 \\ x_1 \\ s_1 \\ s_4 \\ s_5 \\ s_6 \\ \hline -z \end{array}$			$ \frac{s_1}{0} \\ 0 \\ 1 \\ 0 \\ $	$ \frac{s_2}{-2} \\ -2 \\ -2 \\ \frac{1}{2} \\ 2 \\ 2 2 $	$\frac{s_3}{3}$ 1 $-\frac{3}{2}$ -3 -2 -3	$ \frac{s_4}{0} \\ 0 \\ 0 \\ 1 \\ 0 \\ 0 \\ 0 \\ 0 0 1 0 0 0 0 0 $		s ₆ 0 0 0 0 0 0 1 0	$9 \\ 4 \\ 0 \\ 1 \\ 6 \\ -9$
$\begin{array}{c} x_2 \\ x_1 \\ s_1 \\ s_4 \\ s_5 \\ s_6 \\ -z \end{array}$			$ \frac{s_1}{0} \\ 0 \\ 1 \\ 0 \\ 0 \\ 0 \\ s_1 \\ 0 $	$\frac{s_2}{-2}$ -2 -2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	$ \frac{s_3}{3} 2 1 $	$ \frac{s_4}{0} \\ 0 \\ 0 \\ 1 \\ 0 \\ 0 \\ s_4 $	$ \frac{s_5}{0} $ $ \frac{0}{0} $ $ \frac{0}{0} $ $ \frac{s_5}{0} $		$9 \\ 4 \\ 0 \\ 1 \\ 6 \\ -9 \\ 0$
$\begin{array}{c c} x_2 \\ x_1 \\ s_1 \\ s_4 \\ s_5 \\ s_6 \\ \hline -z \\ \hline x_2 \\ x_2 \\ x \end{array}$			$ \frac{s_1}{0} \\ 0 \\ 0 \\ 0 \\ 0 \\ \frac{s_1}{0} \\ 0$	$\frac{s_2}{-2}$ -2 -2 2 2 2 2 2 2 2 2 2 0 0 0	$\frac{s_3}{3}$ 2 1 $-\frac{3}{2}$ -3 -2 -3 -3 -3 -3	$ \frac{s_4}{0} \\ 0 \\ 0 \\ 1 \\ 0 \\ 0 \\ s_4 \\ 4 \\ 4 $			$9 \\ 4 \\ 0 \\ 1 \\ 6 \\ -9 \\ 9 \\ 4$
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	x_1	x_2	x_3	x_4	x_5	x_6	x_7	
x_5	0.5	-5.5	-2.5	9	1	0	0	0
x_6	0.5	-1.5	-0.5	1	0	1	0	0
x_7	1	0	0	0	0	0	1	1
-z	10	-57	-9 -	-24	0	0	0	0
	r_1	r_{0}	r_{2}	r_{A}	r_{r}	T_{c}	$r_{\overline{z}}$	Ĩ
$\overline{x_1}$	1	-11	$\frac{-5}{-5}$	$\frac{\omega_4}{18}$	$\frac{\omega_5}{2}$	$\frac{\omega_0}{0}$	$\frac{\omega_{l}}{0}$	0
$\frac{1}{x_6}$	0	4	2	-8	_ _1	1	0	0
x_7	0	11	5 -	-18	-2^{-2}	0	1	1
-z	0	53	41 -	-204	-20	0	0	0
	r.	<i>m</i>	r_{\circ}	r.	r-	<i>T</i> a	r-	I
r_{1}	$\frac{x_1}{1}$	$\frac{x_2}{0}$	$\frac{x_3}{0.5}$	$\frac{x_4}{-4}$	$\frac{x_5}{-0.75}$	$\frac{x_6}{2.75}$	$\frac{x_{7}}{0}$	0
$\frac{w_1}{x_2}$	0	1	0.5	-2	-0.25	0.25	0	
x_{7}	0	0	-0.5	4	0.75	-2.75	1	1
-z	0	0	14.5 -	-98	-6.75	-13.25	0	0
0								I
	$\frac{x_1}{2}$	$\frac{x_2}{0}$	$\frac{x_3}{1}$	$\frac{x_4}{\circ}$	$\frac{x_5}{1 + 1}$	$\frac{x_6}{\overline{z}}$	$\frac{x_7}{0}$	
x_3		0	1	-8	-1.5	5.5 2.5	0	
x_2		1	0	2	0.5	-2.5	1	
$\frac{x_7}{-\gamma}$	-20	0	0	18	15	03	0	$\begin{bmatrix} 1\\0 \end{bmatrix}$
-2	-23	0	0	10	10	-50	0	0
	x_1	x_2	x_3	x_4	x_5	x_6	x_7	
x_3	-2	4	1	0	0.5	-4.5	0	0
x_4	-0.5	0.5	0	1	0.25	-1.25	0	0
x_{7}	1	0	0	0	0	0	1	1
-z	-20	-9	0	0	10.5	-70.5	0	0
	$ x_1 $	x_2	x_3	x_4	$_{4}$ x_{5}	x_6	x_7	
x_5	-4	8	2	0	1	-9	0	0
x_4	0.5	-1.5	-0.5	1	0	1	0	0
x_7	1	0	0	0	0	0	1	1
-z	22	-93	-21	0	0	24	0	0
	x_1	$\frac{x_2}{r}$	$\frac{x_3}{2}$	$\frac{x_4}{2}$	x_5	$\frac{x_6}{2}$	$\begin{array}{c c} x_7 \\ \hline \end{array}$	0
		-b b	-2.5	9	1	0	0	U
x_5	0.0	0.0						0
$\begin{array}{c} x_5 \\ x_6 \end{array}$	$\begin{array}{c} 0.5\\ 0.5\end{array}$	-1.5	-0.5	1	0	1	0	0
$egin{array}{c} x_5 \ x_6 \ x_7 \end{array}$	$\begin{array}{c} 0.5\\ 0.5\\ 1\end{array}$	$-1.5 \\ 0$	$-0.5 \\ 0$	$\begin{array}{c} 1 \\ 0 \end{array}$	0 0	$\begin{array}{c} 1 \\ 0 \end{array}$	$\begin{array}{c} 0 \\ 1 \end{array}$	$0\\1$