

## PS 2A: Simplex Problem Set for Week 2

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The **due date** for this homework is **Mon 17 Nov 2014 3:00 PM CST**.

This quiz focuses on the concepts of unboundedness, degeneracy and cycling.

- ☐ In accordance with the Coursera Honor Code, I (Kevin Zhu) certify that the answers here are my own work.

### Question 1

Suppose we are solving Simplex on a **standard form** example problem A and observing the objective values obtained at each dictionary, which of the following sequences of objective values are possible during Simplex? Select all possible sequences and make sure wrong answers are not selected,

- ☐  $-1, 0, 0, 1, 0, 1, 0, 1, 0, \dots$  (repeating forever)
- ☐  $2.1, 2.7$
- ☐  $1, 1.2, 1.7, 2.3, 2.3, 2.3, \dots$  (2.3 forever)
- ☐  $1, 2, 3, 4, 5, \dots$  (increasing forever)
- ☐  $4.5, -1, 2.5, -3, -5, \text{UNBOUNDED}$

### Question 2

Consider the degenerate dictionary below:

$x_6$	0.0	$-x_4$	$+0.5x_2$	$+2.5x_1$	$+0x_5$
$x_3$	2.0		$-x_2$	$-2x_1$	$-x_5$
$z$	2.0	$+2x_4$	$-x_2$	$+3x_1$	$+x_5$

Suppose  $x_4$  is entering variable. Select what we can say about the next dictionary.

- ☐ The next dictionary will be degenerate

- ☐ Objective will stay the same
- ☐ The next dictionary will not be degenerate
- ☐ Objective value will increase

### Question 3

Consider the degenerate dictionary below:

$x_6$	0.0	$-x_4$	$+0.5x_2$	$+2.5x_1$	$+0x_5$
$x_3$	2.0		$-x_2$	$-2x_1$	$-x_5$
$z$	2.0	$+2x_4$	$-x_2$	$+3x_1$	$+x_5$

Suppose  $x_1$  is entering variable. Select what we can say about the next dictionary.

- ☐ Objective will remain the same
- ☐ Objective value will increase
- ☐ Next dictionary will be degenerate, as well.
- ☐ Next dictionary will not be degenerate

### Question 4

Consider the degenerate dictionary below:

$x_6$	0.0	$-x_4$	$+0.5x_2$	$+2.5x_1$	$+0x_5$
$x_3$	2.0		$-x_2$	$-2x_1$	$-x_5$
$z$	2.0	$+2x_4$	$-x_2$	$+3x_1$	$+x_5$

Suppose  $x_5$  is entering variable. Select what we can say about the next dictionary.

- ☐ Objective will remain the same
- ☐ Next dictionary will be degenerate
- ☐ Objective will increase
- ☐ Next dictionary will not be degenerate

## Question 5

Suppose we implemented Simplex on a dictionary  $D$  and obtained a new dictionary  $D'$ . We observed the following situation:

- The objective remains the same in  $D, D'$ .

Which of the following may be correctly concluded?

- ☐ Neither dictionary is degenerate.
- ☐ Both  $D, D'$  are degenerate
- ☐  $D'$  is degenerate but  $D$  may not be.
- ☐  $D$  is degenerate, but  $D'$  is not.

## Question 6

Consider the dictionary

$$\begin{array}{c|ccc}
 x_4 & 2.0 & +x_5 & \\
 x_6 & 2.0 & & -x_3 \\
 x_2 & 2.0 & +2x_5 & -2x_3 \\
 x_1 & 4.0 & +x_5 & +x_3 \\
 \hline
 z & 0.0 & +6x_5 & +5x_3
 \end{array}$$

Select all true statements below:

- ☐ Even if we chose  $x_3$  now, simplex will **never** end up with a final dictionary.
- ☐ If we chose  $x_5$  to enter,  $x_2$  will leave
- ☐ Choosing  $x_5$  as entering, we conclude that the problem is unbounded
- ☐ Choosing  $x_3$  allows us to stay bounded for one more iteration.
- ☐ If we chose  $x_3$  as entering, we will end up with a final dictionary.
- ☐ Bland's rule ensures that even if the problem is unbounded, we will get a finite answer.

- ☐ In accordance with the Coursera Honor Code, I (Kevin Zhu) certify that the answers here are my own work.

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