DM554/DM559 – Linear and Integer Programming

Answers to the Written Exam, Spring 2017

WRITE-HERE-YOUR-EXAM-NR

Skriv dit eksamensnummer i sidehovedet.

Sørg for at lave sikkerhedsbackup undervejs. Dette er dit eget ansvar og din sikkerhed ved nedbrud.

Write your exam number in the header.

Make sure you take security copies of your paper while the exam is in progress. It is your own responsibility in case of technical error.

Example of mathematical expression:

x1	x2	x3	x4	x5	x6	-z	b
5/3	0	1	0	10/3	0	0	65/3
11/3	0	0	1	-2/3	0	0	5/3
1/3	1	0	0	-1/3	0	0	1/3
-1/3	0	0	0	1/3	1	0	5/3
5/3	0	0	0	1/3	0	1	-1/3

$$TUM(A) \wedge b \in \mathbb{Z} \implies x^* \in \mathbb{Z} \tag{1}$$

$$\max \quad \sum_{j=1}^{n} c_j x_j \tag{2}$$

$$\text{s.t.} \quad \sum_{j=1}^{n} a_{ij} x_j \geq b_i, \quad i = 1, \ldots, m \tag{3}$$

$$x_j \geq 0, \quad j = 1, \ldots, n \tag{4}$$

$$\begin{bmatrix} 5 & 0 & 1 & 0 & 0 & -10 & 0 & 5 \\ 3 & 0 & 0 & 1 & 0 & 2 & 0 & 5 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 2 \\ -1 & 0 & 0 & 0 & 1 & 3 & 0 & 5 \\ 2 & 0 & 0 & 0 & 0 & -1 & 1 & -2 \end{bmatrix} \tag{5}$$

We need to take the pivot based the smallest value of $\frac{b_i}{A_i 4}$ where i is a given row.
$min\{13/2, 5, \} = 5$
Thus, we can deduce the pivot to be in row A_3

Procedure to do the simplex iteration:
R3' = R3/(1/3)

R0' = R0 + (-10/3) * R3'
R1' = R1 + (2/3) * R3'
R2' = R2 + (1/3) * R3'
R4' = R4 + (-1/3) * R3'

$$\begin{bmatrix} 5 & 0 & 1 & 0 & 0 & -10 & 0 & 5 \\ 3 & 0 & 0 & 1 & 0 & 2 & 0 & 5 \\ 0 & 1 & 0 & 0 & 0 & 1 & 0 & 2 \\ -1 & 0 & 0 & 0 & 1 & 3 & 0 & 5 \\ 2 & 0 & 0 & 0 & 0 & -1 & 1 & -2 \end{bmatrix} \tag{6}$$

Keep the \newpage after every task.

Template for figure inclusion (see latex source):

Template for source code inclusion:

```
import numpy as np
```

Task 1

Task 2

Task 3

Task 4

Task 5

Task 6

Subtask 6.a

Subtask 6.b

Subtask 6.c

Subtask 6.d

Subtask 6.e

Subtask 6.f

Subtask 6.g

Subtask 6.h

Task 7

Subtask 7.a

Subtask 7.b

Task 8

Task 9

Task 10

Subtask 10.a

Subtask 10.b

Subtask 10.c

Subtask 10.d