

## Assignment 4

**Date :**

<b>Code</b>	<b>ITM 524</b>		<b>Title</b>	<b>Management Science</b>	
-	-	<b>Questions</b>		<b>Weighting</b>	<b>5%</b>
<b>Student's Number</b>			<b>Student's Name</b>		

1. (30pts) Solve the following 0-1 integer programming problem using a branch-and-bound algorithm. At each step, report your branching choice, the LP-relaxation bound at the node, and the current best feasible 0-1 solution (and its objective value).

$$\text{Maximize } Z = 8x_1 + 11x_2 + 6x_3$$

(subject to)

$$5x_1 + 7x_2 + 4x_3 \leq 14$$

$x_j$  is binary for  $j = 1, 2, 3$

(Note: You must follow the procedure of branch and bound method)

Refer attachment for LP relaxation solutions

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Subproblems	LP relaxation – optimal solution	$Z_{LP}$
Original	(1,1,0.5)	22
$x_1=0$	(0,1,1)	17
$x_1=1$	(1,1,0.5)	22
$x_2=0$	(1,0,1)	14
$x_2=1$	(1,1,0.5)	22
$x_3=0$	(1,1,0)	19
$x_3=1$	(1,5/7,1)	21.86
$x_1=0, x_2=0$	(0,0,1)	6
$x_1=0, x_2=1$	(0,1,1)	17
$x_1=0, x_3=0$	(0,1,0)	11
$x_1=0, x_3=1$	(0,1,1)	17
$x_2=0, x_3=0$	(1,0,0)	8
$x_2=0, x_3=1$	(1,0,1)	14
$x_1=1, x_2=0$	(1,0,1)	14
$x_1=1, x_2=1$	(1,1,0.5)	22
$x_1=1, x_3=0$	(1,1,0)	19
$x_1=1, x_3=1$	(1,5/7,1)	21.86
$x_2=1, x_3=0$	(1,1,0)	19
$x_2=1, x_3=1$	(0.6,1,1)	21.8
(0,0,0)	(0,0,0)	0
(0,0,1)	(0,0,1)	6
(0,1,0)	(0,1,0)	11
(0,1,1)	(0,1,1)	17
(1,0,0)	(1,0,0)	8
(1,0,1)	(1,0,1)	14
(1,1,0)	(1,1,0)	19
(1,1,1)	Infeasible	-

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2. (30pts) From the inequality below, which arises in a pure 0-1 integer programming problem, derives as many valid cutting planes as possible (use minimum cover).

$$3x_1 + 5x_2 + 4x_3 + 8x_4 \leq 10$$

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3. (40pts) A student has 7 days to prepare for final exam in four courses and wants to allocate this time as effectively as possible. She must spend at least 1 day on each course, and prefers to focus on a single course per day. Therefore, the allowable study-time choices per course are 1, 2, 3, or 4 days. She decides to use dynamic programming to choose the allocation that maximizes total grade points. The estimated grade points for each course under the alternative day allocations are

Study days	Estimated Grade Points			
	Course			
	1	2	3	4
1	1	5	4	4
2	3	6	6	4
3	6	8	7	5
4	8	8	9	8

Use dynamic programming to determine how many days to assign to each course (subject to 7 day total and the 1-4 days per course limits) so as to maximize the sum of grade points.

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