Design and Analysis of Algorithms (CS F364) Quiz 3, 2018
(Open Book)

There are 2 questions in this quiz with total marks $20 = 10 + (5 + 5)$. Time: 40 minutes. Only hard copies of textbooks, reference books, and lecture notes are allowed. No electronic instuments (calculator, mobile phone, tablet, laptop etc.) are allowed. Show all computation steps for solving any problem.

1. Find the *Dual LP* for the following *Primal LP* showing all the steps involved (as demonstrated during the lecture):
   minimize $19x_1 + 20x_2 + 21x_3 + 22x_4$
   subject to
   $x_1 + 2x_2 \geq 3$
   $4x_1 + 5x_3 \geq 6$
   $7x_1 + 8x_4 \geq 9$
   $10x_2 + 11x_3 \geq 12$
   $13x_2 + 14x_4 \geq 15$
   $16x_3 + 17x_4 \geq 18$
   $x_1, x_2, x_3, x_4 \geq 0$
   (Marking Scheme: 5M for correct solution, 3M for correctly showing correspondence between variables and constraints of Primal LP and Dual LP, 2M for demonstrating how you get the objective function of Dual LP)

2. Consider the following algorithm $A()$:
   0 $A()$
   1 $j \leftarrow 2$
   2 do
   3    $j \leftarrow j + 1$
   4    $n \leftarrow \text{RANDOM}(0, j - 1)$
   5 while $n > 1$
   6 output j
   Here $\text{RANDOM}(m, n)$ returns a random number between m and n (both inclusive) with uniform probability.

   (a) Find the probability of halting of $A()$.

   (b) Find the expected number of iterations of the while loop in $A()$.