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RAJARATA UNIVERSITY OF SRI LANKA

FACULTY OF APPLIED SCIENCES

B.SC (General) Degree

Third Year – Semester II Examination – April/ May 2016

MAT3310 Integer Programming

Answer **ALL** Questions. Time allowed: **Three hours.**

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01. (a) In a mixed integer programming problem

(i) all of the decision variables require integer solutions.

(ii) few of the decision variables require integer solutions.

(iii)different objective functions are mixed together.

(iv)none of the above.

(b)The use of cutting plane method

(i)reduces number of constraints in the given problem.

(ii)yields better value of objective function.

(iii)requires use of standard LP approach between each cutting plane application.

(iv)all of the above.

(c)The 0-1 integer programming problem

(i) requires the decision variables to have values between zero and one.

(ii)requires that the constraints have coefficients between zero and one.

(iii)requires that the decision variables have coefficients zero and one.

(v) none of the above.

(d) The part of the feasible solution space eliminated by plotting a cut contains

(i)only non-integer solutions.

(ii) only integer solutions.

(iii) both (i) and (ii).

(iv) none of the above.

(e) Rounding off solution values of the decision variables in an LP problem may not be acceptable for the corresponding IP problem because

(i)it does not satisfy constraints.

(ii)it violates non-negativity constraints/conditions.

(iii)objective function value is less than the objective function value of LP.

(iv)none of the above.

(f) Write constraints to satisfy each of the following conditions in a project selection model. The projects are numbered 1 , 2 , 3 , . . . and 10:

(i) Exactly one project from the set (1 , 2 , 3) must be selected.

(ii) Project 2 can be selected only if project 10 is selected. However, 10 can be selected without 2 being selected.

(iii) No more than one project from the set (1 , 3 , 5 , 7 , 9) can be selected.

(iv) If project 4 is selected , then project 8 cannot be selected.

(v) Project 4 and project 10 must be selected or both be rejected.

02. (a) What is the cutting plane algorithm in Integer Programming.

(b) Solve the following problem using the *Dual fractional integer programming algorithm:*

Minimize $Z = 2y_1 + y_2$

subject to the constraints

$6y_1 + y_2 \geq 3$

$4y_1 + 5y_2 \leq 20$

$y_1 \geq 0$, $y_2 \geq 0$ and all are integer .

03. Outline the ***Land an Doig algorithm*** of the Branch and Bound Algorithm, and explain how this algorithm can be applied to a 0-1 Integer Programming Problem.

A tailor makes wool tweed sport coats and wool slacks. He is able to get a shipment of 150 square yards of wool cloth form Scotland each month to make coats and slacks, and he has 200 hours of his own labor to make them each month. A coat requires 3 square yards of wool and 10 hours to make, and a pair of pants requires 5 square yards of wool and 4 hours to make. He earns $ 50 in profit from each coat he makes and $40 from each pair of slacks. He wants to know how many coats and slacks to produce to maximize the profit.

(i). Formulate an Integer Linear Programming model for this problem.

(ii). Determine the integer solution to this problem using the Branch and Bound method. Compare this solution with the solution ignoring the integer requirements and indicate if the rounded-off solution would have been optimal.

04. Briefly explain the steps of ***Dual All Integer– Integer Programming Algorithm.***

Consider the following Integer Programming Problem [IPP]:

$$\text{Maximize } z = 3x_1 + 8x_2$$
$$10x_1 + 10x_2 \le 9$$
$$10x_1 + 5x_2 \ge 1$$
$$-x_1 + 2x_2 \le 1$$
$$x_1, x_2 \ge 0 \text{ and integer.}$$

(i) Using the above algorithm, show that the above IPP has no feasible solution.

(ii) Verify the result in part (i) , using the graphical method.

05. A company produces two products, A and B. Each unit of product A requires one hour of engineering services and five hours of machine time. To produce one unit of product B, two hours of engineering and 8 hours of machine time are needed. There are 100 hours of engineering and 400 hours of machine time available. The cost of production is non- linear function of the quantity produced as given in the following table:

Product A		Product B	
Production (units)	Unit cost (Rs)	Production (units)	Unit cost (Rs)
0-50	10	0-40	7
51-100	8	41-100	3

The unit selling price of product A is Rs.12 and of product B is Rs.14. The company would like a production plan which gives the number of units ofA and number of units of B to be produced that will maximize profit.

(i) Formulate the above problem as an Integer Programming Problem to help the company to maximize the total revenue.

(ii) Solve the above problem using graphical method.