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15/ENG02/012

COE512 CLASSWORK

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QUESTION ONE

Linear Programming is the process of obtaining a linear equation from a system, it is one of the simplest ways to perform optimization. It helps you solve some very complex optimization problems by making a few simplifying assumptions. Linear programming is the process of taking various linear inequalities relating to some situation, and finding the "best" value obtainable under those conditions. A typical example would be taking the limitations of materials and labor, and then determining the "best" production levels for maximal profits under those conditions.

Applications

1. **TRANSPORTATION OPTIMIZATION:** Transportation systems rely upon linear programming for cost and time efficiency. Bus and train routes must factor in scheduling, travel time and passengers. Airlines use linear programming to optimize their profits according to different seat prices and customer demand Airlines also use linear programming for pilot scheduling and routes. Optimization via linear programming increases airlines efficiency and decreases expenses.
2. **EFFICIENT MANUFACTURING:** Manufacturing requires transforming raw materials into products that maximize company revenue. Each step of the manufacturing process must work efficiently to reach that goal. For example, raw materials must past through various machines for set amounts of time in an assembly line. To maximize profit, a company can use a linear expression of how much raw material to use. Constraints include the time spent on each machine. Any machines creating bottlenecks must be addressed. The number of products made may be affected, in order to maximize profit based on the raw materials and the time needed.

3. **ENERGY INDUSTRY:** Modern energy grid systems incorporate not only traditional electrical systems but also renewables such as wind and solar photovoltaic. In order to optimize the electric load requirements, generators, transmission and distribution lines, and storage must be taken into account. At the same time, costs must remain sustainable for profits. Linear programming provides a method to optimize the electric power system design. It allows for matching the electric load in the shortest total distance between the generation of the electricity and its demand over time. Linear programming can be used to optimize load-matching or to optimize cost, providing a valuable tool to the energy industry.
4. **Application oriented multimedia:** Learning media is something that can be used to deliver a message from the sender to the receiver so that the learning process will occur. Media are physical means which are used to send messages to the students and stimulate them to learn. Learning Media is a combination of hardware and software. There are several types of media that is media graphics, audio and multimedia. Multimedia can be defined as an interactive communication system and combination from the data operators, such as the internet and software. Multimedia is a media associated with the use of technology like computers and software. The advantageous of multimedia in teaching is to increase students' learning experiences make time efficiency, create a conducive learning environment actively participate in the learning process and improve students' enthusiasm and performance.
5. **MAJOR LPP APPLICATIONS IN ENGINEERING:** In nutrition, linear programming provides a powerful tool to aid in planning for dietary needs. In order to provide healthy, low – cost food baskets for needy families, nutritionists can use linear programming. Constraints may include dietary guidelines, nutrient guidance, cultural acceptability or some combination, Mathematical modelling provides assistance to calculate the foods need to provide nutrition at low cost in order to prevent non-communicable disease. Linear programming also allows time variations for the frequency of making such food baskets. Engineers also use linear programming to help solve design and manufacturing problems.

QUESTION TWO

Class work

Question 2.

The objective function is

Max $Z = 30x_1 + 20x_2$

Subject to;

$2x_1 + x_2 \leq 1000$

$x_1 + x_2 \leq 800$

$x_1 \leq 350$

$x_i \geq 0$ i.e $x_1, x_2 \geq 0$

After adding slack variables S_1, S_2, S_3 to the Constraints, and moving the Variables of the objective function to the left.

x_1	x_2	S_1	S_2	S_3	Z	Constraints
2	1	1	0	0	0	1000
1	1	0	1	0	0	800
1	0	0	0	1	0	350
-30	-20	0	0	0	1	0

Ignoring the last Constraint

Using the lowes indicator -30

Dividing the Constraints by the corresponding values in the Indicator Colymn

	x_1	x_2	S_1	S_2	S_3
R_1	2	1	1	0	1000
R_2	1	1	0	1	800
R_3	-30	-20	0	0	0

Ignoring the last Constraint

$R_1 = 1000/2 = 500$; $x_1 = 2/2$, $x_2 = 1/2$, $S_1 = 1/2$

$R_2 = -R_1 + R_2$

$R_3 = 30R_1 + R_3$

where $R_1 = \frac{\text{Row 1}}{2}$

x_1	x_2	S_1	S_2	Z
1	1/2	1/2	0	500
1	1	0	1	800
-30	-20	0	0	0

~~x_1 x_2 S_1 S_2 Z~~

1 Row 3

Row 2

x_1 $R_3 = 30(1) + -30$ | $-1 + 1 = 0$ | x_1

$= 0$

x_2 $R_3 = 30(1/2) + (-20)$ | $1 + -1/2 = +1/2$ | x_2

$15 - 20$

$= -5$

S_1 $R_3 = 30(1/2) + 0$ | $-1/2 + 0 = -1/2$ | S_1

$= 15$

S_2 $R_3 = 30(0) + 0) = 0$ | $-0 + 1 = 1$ | S_2

~~$R_3 = 30(-20) +$~~ | $-500 + 800 = 300$ | Z.

x_1	x_2	S_1	S_2	Z
1	1/2	1/2	0	500
0	1/2	-1/2	1	300
0	-5	15	0	15000

1	1/2	1/2	0	500
0	1/2	-1/2	1	300
0	-5	15	0	15000

$R_2 \rightarrow 2R_2$

x_1	x_2	S_1	S_2	Z
1	1/2	1/2	0	500
0	1	-1	2	600
0	-5	15	0	15000

$R_1 = -\frac{1}{2} R_2 + R_1$

$R_3 = 5R_2 + R_3$

x_1	x_2	S_1	S_2	Z
$-\frac{1}{2}(0)+1$	$-\frac{1}{2}(1)+\frac{1}{2}$	$-\frac{1}{2}(-1)+\frac{1}{2}$	$-\frac{1}{2}(2)+0$	$-\frac{1}{2}(600)+500$
0	1	-1	2	600
$5(0)+0$	$5(1)+-5$	$5(-1)+15$	$5(2)+0$	$5(600)+15000$

x_1	x_2	S_1	S_2	Z
1	0	1	-1	200
0	1	-1	2	600
0	0	10	10	18000

1. $x_1 = 200$ $x_2 = 600$ and

$Z = 18,000$