<u>**Questions Bank For Water Resource Managment**</u>

Q1: Find the feasible region and the optimal solution of the following L.P.P:

Max $Z = 5x_1 + 4x_2$

Sub. To

$2x_1 + 4x_2 \leq 8$

$-2x_1 + x_2 \leq 2$

$3x_2 \leq 9$

$4x_1 + x_2 \leq 4$

$x_1, x_2 \geq 0$

Q2: find the feasible region and the optimal solution for the following L.P.P model using Graphical method.

Min $Z = 4x_1 + 8x_2$

Sub. To

$4x_1 + 2x_2 \leq 8$

$-7x_1 + 4x_2 \leq 28$

$8x_1 + 6x_2 \leq 48$

$4x_1 - x_2 \leq 4$

$x_1, x_2 \geq 0$

Q3: find the feasible region and the optimal solution for the following L.P.P model using Graphical method.

Maximize $z = x_1 + 2x_2$

subject to $x_1 \leq 80$

$x_2 \leq 60$

$5x1 + 6x2 \leq 600$

$x1 + 2x2 \leq 160$

$x1, x2 \geq 0$

Q4: find the feasible region and the optimal solution for the following L.P.P model using Graphical method.

Min $Z = x1-3x2-2x3$

Sub. To $3x1 -x2+2x3 \leq 7$

$-2x1+4x2 \leq 12$

$-4x1+3x2+8x3 \leq 10$

$x1,x2,x3 \geq 0$

Q5: find the feasible region and the optimal solution for the following L.P.P model using Graphical method.

Minimize $z = 200x1 + 300x2$

subject to $2x1 + 3x2 \geq 1200$

$x1 + x2 \leq 400$

$2x1 + 1.5x2 \geq 900$

$x1, x2 \geq 0$

Q6: find the feasible region and the optimal solution for the following L.P.P model using Graphical method.

Minimize $z = 40x1 + 60x2$

subject to $2x1 + x2 \geq 70$

$x1 + x2 \geq 40$

$x1 + 3x2 \geq 90$

$x1, x2 \geq 0$

Q7: find the feasible region and the optimal solution for the following L.P.P model using Graphical method.

Objective function

$Z_{max}=f(x)=40x_1+88x_2$

Subjected to:

$2x_1+8x_2\leq 60$

$5*x_1+2*x_2\leq 60$

$X1\geq 0$

$X2\geq 0$

Q8: find the feasible region and the optimal solution for the following L.P.P model using Graphical method.

Minimize Z=-6 X1-2 X2

With constraints:

$2\ X1+4\ X2\leq 9$

$3\ X1+X2\leq 6$

$X1,\ X2\geq 0$

Q9: find the feasible region and the optimal solution for the following L.P.P model using Graphical method.

Maximize Z=X1+X2

With constraints:

$X1-X2\geq 1$

$X2\leq 2$

$X1,X2\geq 0$

Q10: find the feasible region and the optimal solution for the following L.P.P model using Graphical method.

Min . $z = 2x1 + 3x2$

Subject to :- $x1 + x2 \geq 10$

$3 x1 + 5 x2 \leq 15$

$X \geq 0$

Q11: find the feasible region and the optimal solution for the following L.P.P model using Graphical method.

Max. $z = x1 + x2$

Subject to :- $x1 – x2 \geq 1$

$x2 \leq 2$

$X \geq 0$

Q12: find the feasible region and the optimal solution for the following L.P.P model using Graphical method.

Minimize $Z=2 X1+ 3 X2$

With constraints:

$X1 +X2\geq 10$

$3 X1+5 X2\leq 15$

$X1,X2 \geq 0$

Q13:Suppose a farmer has 75 acres on which to plant two crops: wheat and barley. To produce these crops, it costs the farmer (for seed, fertilizer, etc.) $120 per acre for the wheat and $210 per acre for the barley. The farmer has $15,000 available for expenses. But after the harvest, the farmer must store the crops while awaiting favorable market conditions. The farmer has storage space for 4,000 bushels. Each acre yields an average of 110 bushels of wheat or 30 bushels of barley. If the net profit per bushel of wheat (after all expenses have been subtracted) is $1.30 and for barley is $2.00, how should the farmer plant the 75 acres to maximize profit?

Q14: find the feasible region and the optimal solution for the following L.P.P model using Graphical method.

Minimize Z=-3*X1-4*X2

With following constraints :

X1+X2≤ 20 ....(1)

X1+4*X2≥ 20 ....(2)

X1≥10 ....(3)

X2≤5 ....(4)

X1,X2≥0

Q15: find the feasible region and the optimal solution for the following L.P.P model using Graphical method.

Minimize Z = 40 x1 + 36 x2

subject to x1 ≤ 8 ……………. (1)

x2 ≤ 10 ……………. (2)

5x1 + 3x2 ≥45 ……………. (3)

x1 , x2 ≥ 0

Q16: find the feasible region and the optimal solution for the following L.P.P model using Graphical method.

Maximize Z = 5 x1 + 4 x2

subject to 2x1 − 3x2 ≤ 6 ……………. (1)

5x1 + 2x2 ≤ 15 ……………. (2)

− x1 + 6x2 ≤ 8 ……………. (3)

x1 , x2 ≥ 0

Q17:A contractor is considering two material pits to supply a project. The unit cost to load and deliver the material to the project site is 5 $/m3 from pit 1 and 7 $/m3 from pit 2. He must deliver a minimum of 10,000 m3 to the site. The material of pit 1 consists of 30% sand and 70% gravel. The material of pit 2 consists of 60% sand, 30% gravel and 10% silt. The delivered mix must contain at least 50% sand, not more than 60% gravel and not more than 8% silt. Formulate a minimum-cost model and solve it.

Q18:A farmer produces two crops: wheat and rice. The farmer has a production capacity of 40 ton of crops. Because of limited sale opportunity, he can sell a maximum of 30 ton of wheat and 24 ton of rice. The gross margin from the sale of 1 ton of wheat is 100,000 ID and from 1 ton of rice is 80,000 ID. Find the optimal production.

Q19:A company manufactures sluice gates of types A and B. The wholesale price is $40 per gate for A and $88 for B. Two machines M1 and M2produce the gates. On M1 it requires 2 min for producing anAgate and 8 min for aBgate. On M2one needs 5 min for an Agate and 2 min for a Bgate. Determine the optimum number of sluice gates produced per hour so that the hourly revenueis maximum.

Q20:

Formulate the problem of selecting the best alternative for the farm cropping pattern by building an analytical model for the problem below:

Crop	Irrigation Water (cm)	Total Operational Expenses ($ /don)	Gross Return ($ /don)
A	35	900	1400
B	15	150	550

Available Resources: Land = 40 don; Capital = $15000; Water = 735 don.cm

Q21:In the planning of a two-roomed building, the contract states that the total floor area of the building must be at least 500 m2 and that each room must have a maximum area of 500 m2 and 300 m2 , respectively. The goal is to maximize the total revenue, assuming that the revenue per m2 of the rooms are $50 and $60, respectively. Formulate a mathematical model for the problem and solve it graphically.

Q22:Use the simplex method to maximize

$P=6x+2y$

subject to the constraints

$2x + y \leq 10$

$x + y \leq 8$

$x \geq 0$

$y \geq 0$

Q23:using simplex method to solve the following L.P problem:

Min. $z = -2x_1 - 4x_2$

St: $3x_1 + 4x_2 \leq 1700$

$2x_1 + 5x_2 \leq 1600$

$X \geq 0$

Q24:using simplex method to solve the following L.P problem:

Max. $z = 2x_1 + 4x_2$

St: $5x_1 + 7x_2 \leq 5$

$3x_1 + 2x_2 \leq 6$

$X \geq 0$

Q25:using simplex method to solve the following L.P problem:

Min. $z = 2x_1 + 3x_2 + 8x_3$

Subject: $x_1 - 5x_2 - 10x_3 \geq 10$

$-x1 + 3x2 + 4x3 \leq 15$

$X \geq 0$

Q26:using simplex method to solve the following L.P problem:

Min. $z = 8x1 - 2x2 - 3x3$

Subject: $5x1 - 5x2 - 3x3 \leq 15$

$2x1 - x2 - x3 \leq 10$

$X \geq 0$

Q27:using dual simplex method to solve the following L.P problem:

Min. $z = 2x1 + 3x2 + x3$

Subject: $2x1 + x2 - x3 \geq 10$

$x1 + 3x2 + 2x3 \geq 15$

$X \geq 0$

Q28:using simplex method to solve the following L.P problem:

Min . $z = -2x1 - x2$

St: $2x1 + 4x2 \geq 4$

$-x1 + 3x2 = 10$

$x1 + x2 \leq 6$

$x1 - x2 \leq 3$

$X \geq 0$

Q29:using simplex method to solve the following L.P problem:

Min . $z = -2x1 - 3x2 - 4x3$

St: $x1 - 2x2 + x3 \geq 1\ 2$

$x1 - x2 - 2x3 = 5$

$-x1 + x2 + 3\ x3 \le 6$

$X \ge 0$

Q30:using simplex method to solve the following L.P problem:

Min . $z = 4x1 + x2 + x3$

St: $2\ x1 + x2 + 2\ x3 = 4$

$3\ x1 + 3\ x2 + x3 = 3$

$X \ge 0$

Q31:using simplex method to solve the following L.P problem:

Max . $z = 3x1 + 4\ x2$

St: $x1 + 2\ x2 \ge 10$

$x1 - x2 = 5$

$-x1 + 3\ x2 \le 20$

$X \ge 0$

Q32:using simplex method to solve the following L.P problem:

Min . $z = -3\ x1 - 4x2$

St: $x1 - 2\ x2 \ge 10$

$-x1 + x2 = 5$

$2x1 + 2\ x2 \le 20$

$X \ge 0$

Q33:using simplex method to solve the following L.P problem:

Min . $z = x2 + x3$

St: $2 x1 - 5 x2 + 7 x3 \geq 0$

$x1 - x2 + 2 x3 = 2$

$x1 - 2 x2 + 3 x3 \leq 1$

$X \geq 0$

Q34:using dual simplex method to solve the following L.P problem:

Min $Z = 3x1 + 2x2 + 3x3$

Sub. to

$x1 + 4x2 + x3 \geq 7$

$2x1 + x2 + x4 \geq 10$

$x1, x2, x3, x4 \geq 0$

Q35:using dual simplex method to solve the following L.P problem:

Min $Z = 5x1 + 6x2$

Sub. to $x1 + 9x2 \leq 60$

$2x1 + 3x2 \leq 45$

$5x1 + 2x2 \geq 20$

$x1, x2 \geq 0$

Q36: Use simplex method to solve the following linear programming problem (L.P.P).

Max $Z = 12x1 + 8x2$

Sub. To

$8x1 + 6x2 \leq 2200$

$4x1+9x2 \leq 1800$

$x1+ 2x2 \leq 400$

$x1,x2 \geq 0$

Q37:solve by simplex method

Maximize $Z = 5 x1 + 4 x2$

subject to

$2x1 - 3x2 \leq 6$

$5x1 + 2x2 \leq 15$

$- x1 + 6x2 \leq 8$

$x1 , x2 \geq 0$

Q38:

:(by simplex)A manufacturer produces three types of plastic fixtures. The time required for molding, trimming, and packaging is given in Table. (Times are given in hours per dozen fixtures.)

Process	*Type A*	*Type B*	*Type C*	*Total time available*
Molding	1	2	$\frac{3}{2}$	12,000
Trimming	$\frac{2}{3}$	$\frac{2}{3}$	1	4,600
Packaging	$\frac{1}{2}$	$\frac{1}{3}$	$\frac{1}{2}$	2,400
Profit	\$11	\$16	\$15	—

How many dozen of each type of fixture should be produced to obtain a maximum profit?

Q39:Find the dual problem of the following L.p primal problem:

1) Max $Z=5x1+12 x2+4x3$

Sub.to $x1+2x2+x3 \leq 10$

$2x1- x2+3x3=8$

$x1, x2, x3 \geq 0$

Q40:Find the dual problem of the following L.p primal problem:

Max Z=x1- x2

Sub.to 2x1+x2=5

3x1- x2=6

x1, x2 unrestricted

Q41:Find the dual problem of the following L.p primal problem:

Max Z=5x1+20x2

s.t 5x1+2x2≤20

x1+2x2≤8

x1+6x2≤12

x1,x2 ≥0

Q42:Find the dual problem of the following L.p primal problem:

Max Z=5x1+4x2

s.t x1+2x2≤6

2x1+2x2≤8

-x1+x2≤1

x2≤2

x1,x2 ≥0

Q43:A company produces two types of construction materials: concrete patching product (CONP) and decorative brick mortar (MORT). The company can sell the CONP for a profit of LE 140/ton and the MORT for a profit of LE 160/ton. Each ton of the CONP requires 2 m3 of the red clay and each ton produced of the MORT requires 4 m3 .A maximum of 28 m3of the red clay could be available every week. The machine used toblend these products can work only a maximum of 50 hr/week. This machineblends a ton of either product at a time, and the blending process requires 5 hr tocomplete. Each material must be stored in a separate curing vat, thus limiting the overallproduction volume of each product. The curing vats for CONP and MORT have capacitiesof 8 and 6 tons, respectively. What is optimal production strategy for the company giventhis information?

Q44:-A diet for a sick person must contain at least 4,000 units of vitamins, 50 units of minerals and 1,400 calories. Two foods A and B are available at a cost of Rs. 4 and Rs. 3 per unit, respectively. If one of A contains 200 units of vitamins, 1 unit of mineral and 40 calories and one unit of food B contains 100 units of vitamins, 2 units of minerals and 40 calories. Formulate this problem as an LP model and solve it by graphical method to find combination of foods to be used to have least cost?

Q45:Solve the following LPP by using Big -M Method

Max Z =3x1 + 2x2 + x3

Subject to

2x1 + x2 + x3 = 12

3x1 + 4x2 = 11

and x1 is unrestricted

x2 ≥ 0, x3 ≥ 0

Q46:Solve the following LPP by using Big -M Method

Minimize Z = 5 x1 + 7 x2

such that: -2x1 + x2 ≥ 0

-x1 +3x2 ≥ 0

-4x1 + x2 ≤ 0

x1 + x2 ≥ 10,000

$x1 , x2 \geq 0$

Q47: Use penalty (or Big 'M') method to

Maximize $Z = 50 x1 + 60 x2$

subject to $x1 + x2 \geq 500$

$x1 \leq 500$ $x2 \leq 300$

$x1 , x2 \geq 0$

Q48: Use penalty (or Big 'M') method to

Minimize $z = 4x_i + 3x_2$

subject to the constraints :

$2x_1 + x_2 \geq 10, \quad -3x_1, + 2x_2 \leq 6$

$x_1 + x_2 \geq 6, \quad x_1 \geq 0$ and $x_2 \geq 0$.

Q49:Solve the following LPP by using Big -M Method

Maximize $Z = 6X_1+4X_2$
Subject to constraints:

$2X_1+3X_2<=30$
$3X_1+2X_2<=24$
$X_1+X_2>=3$

Q50:Solve the following problem using Big-M method:

Min $Z = 2x1 +x2$

Sub. to $3x1+ x2\geq 3$

$4x1+3x2 \geq 6$

$x1 + 2x2 \leq 3$

$x1, x2 \geq 0$

Q51:Solve the following problem using Big-M method:

Maximize $z = 5x1 + x2$

Subject to $x1 \leq 10$

$x1 - 2x2 \geq 3$

$x1 + x2 = 12$

$x1, x2 \geq 0$

Q52:Solve the following problem using Big-M method:

Minimize $z = 4x1 + x2$

Subject to:

$3x1 + x2 = 3$

$4x1 + 3x2 >= 6$

$x1 + 2x2 <= 4$

$x1, x2 >= 0$

Q53:Solve the following problem using Big-M method:

Min $z = 2x1+3x2$

s.t. $1/2x1+1/4x2 \leq 4$…………………1

$x1+3x2 \geq 20$……………………….2

$x1+x2=10$…………………………3

$x1,x2 \geq 0$

Q54:Solve the following problem using Big-M method:

Max $z= 5x1+12x2+4x3$

$X1+2x2+x3 \leq 5$

$2x1+x2+3x3=2$

$X1\geq 0$ $x2\geq 0$ $x3\geq 0$

Q55:Solve the following problem using Big-M method:

MIN $z=4x1+x2$

S.T $3x1+x2=3$

$4x1+3x2\geq 6$

$X1+2x2\leq 4$

$X1\geq 0,x2\geq 0$

Q56:Solve the following problem using Big-M method:

Max $z = 3x1 + 2x2+ x3$

S.T. $2x1 + x2+ x3= 12$

$3x1+ 4x3=11$ $X2\geq 0$

$x3\geq 0$ and x1 is unrestricted

Q57:Stream 1 and 2 each possessed a reservoir, join to form a common stream 3, as shown below. The total benefits derived from annual releases x1+x2 from each reservoir are B=5x1+3x2 The maximum capacity of reservoir 1 is (11 MAF) and the maximum capacity of reservoir 2 is (10 MAF). (MAF=mean annual flow) Initial storage in each of reservoir at the beginning of the year is (7 MAF). Annual inflow from stream 1 and 2 are (5MAF and 4MAF) respectively. The maximum capacity of channels 1,2 and 3 are (6MAF,5MAF and 9MAF) respectively. Formulate the optimization for maximum benefit

Q58:Determine the optimal solution to this nonlinear programming model using the method of Lagrange multipliers.

Minimize $f(x)=5x1\ 2+x2\ 2\ +4$

Subject to $x2\ -4\geq -4\ x1$

-x2+3 ≤ 2 x1

Q59:Determine the optimal solution to this nonlinear programming model using the method of Lagrange multipliers.

Minimize f(x)=x1 2+x2 2 -6x1 -6x2+10

Subject to x1 - 2x2+4 ≥0

2x1+ x2 ≥0

Q60:Determine the optimal solution to this nonlinear programming model using the method of Lagrange multipliers.

Minimize : Z=4 x2+ 5 y2

Subjected to : 2x +3y=6

Q61:The Riverwood Paneling Company makes two kinds of wood paneling, Colonial and Western. Thecompany has developed the following nonlinear programming model to determine the optimal number of sheets of Colonial paneling and Western paneling to produce to maximize profit, subject to a labor constraint:

maximize $Z = \$25x1 - 0.8x_1^2 + 30x2 - 1.2x_2^2$

subject to

x1 + 2x2 = 40 hr.

Determine the optimal solution to this nonlinear programming model using the method of Lagrange multipliers.

Q62:Use the method of Lagrange multipliers to solve the following Maximum: f(x ,y ,z)=y z +x y

subject to the constraints:

x y=1…………….(1)

$y^2+z^2=1$…………(2)

Q63:Determine the optimal solution to this nonlinear programming model using the method of Lagrange multipliers.

Maximize

u = 4x2 + 3xy + 6y2

subject to

x + y = 56

Q64: The Rolling Creek Textile Mill produces denim and brushed-cotton cloth. The company has developed the following nonlinear programming model to determine the optimal number of yards of denim(x_1) and brushed cotton (x_2)to produce each day to maximize profit, subject to a labor constraint:

maximize Z = \$10x1 - 0.02x_1^2 + 12x2 - 0.03x_2^2

subject to: $x_1 + 2x_2 = 40$ hr.

Determine the optimal solution to this nonlinear programming model using the method of Lagrange multipliers.

Q65:Determine the optimal solution to this nonlinear programming model using the method of Lagrange multipliers.

Maximize z = f(x, y)= xy

subject to the constraint

$x + y \leq 100$

Q66:A firm produces two goods, x and y. Due to a government quota, the firm must produce subject to the constraint x + y = 42. The firm's cost functions is

$c(x, y)=8x^2 - xy + 12y^2$

Determine the optimal solution to this nonlinear programming model using the method of Lagrange multipliers.

Q67:Use the method of Lagrange multipliers to find the maximum value of

$f(x, y) = 9x + 36xy - 4 - 18x - 8y$

st: $3x + 4y = 32$

Q68:Determine the optimal solution to this nonlinear programming model using the method of Lagrange multipliers.

Maximize $z = 8x_1 + 10x_2 - x^2_1 - x^2_2$

subject to $3x_1 + 2x_2 \leq 6$

$x_1, x_2 \geq 0$

Q69:Determine the optimal solution to this nonlinear programming model using the method of Lagrange multipliers.

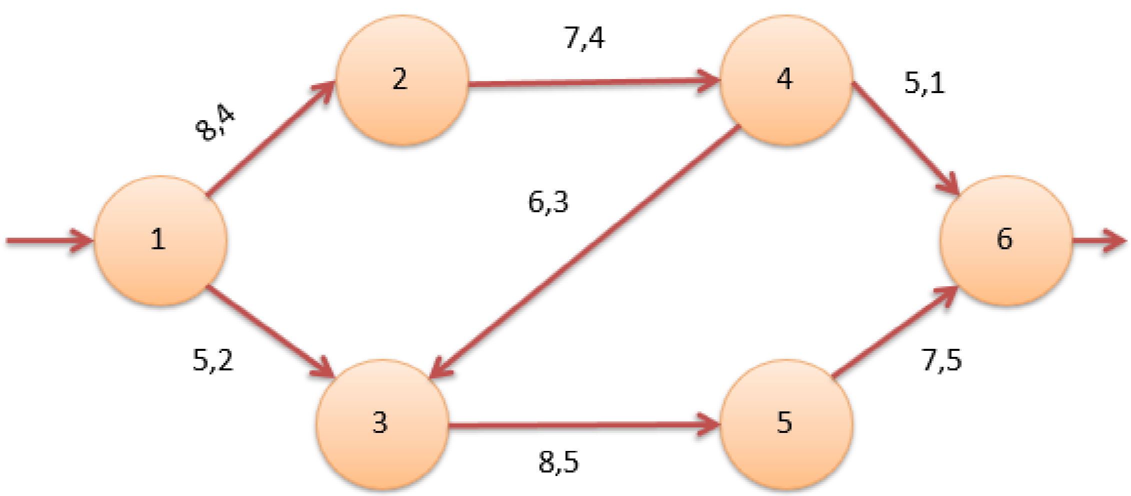
Maximize $z = -x^2 1 - x^2 2 - x^2 3 + 4x_1 + 6x_2$

subject to $x_1 + x_2 \leq 2$

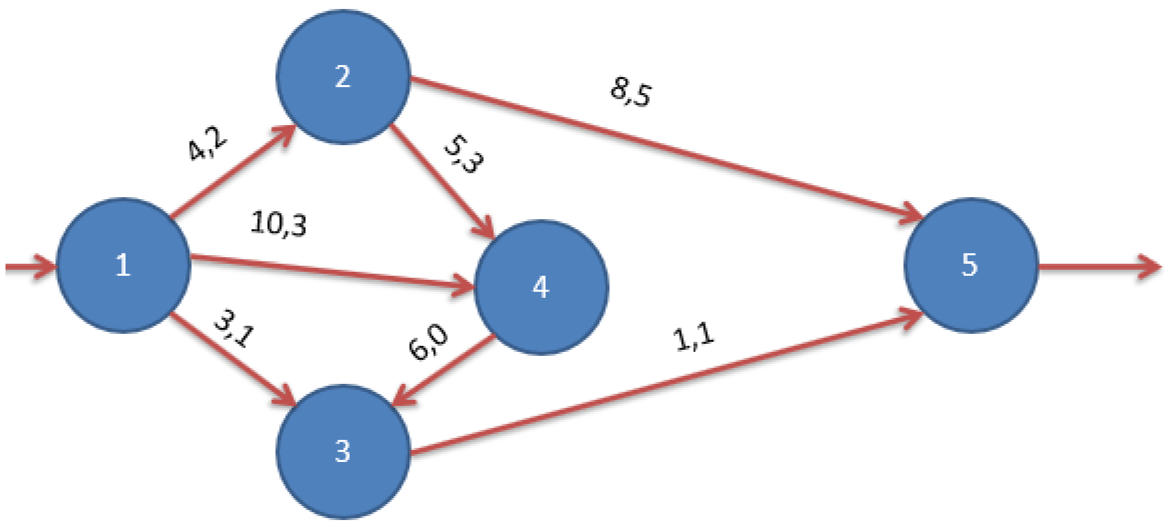
$2x_1 + 3x_2 \leq 12$

$x_1, x_2 \geq 0$.

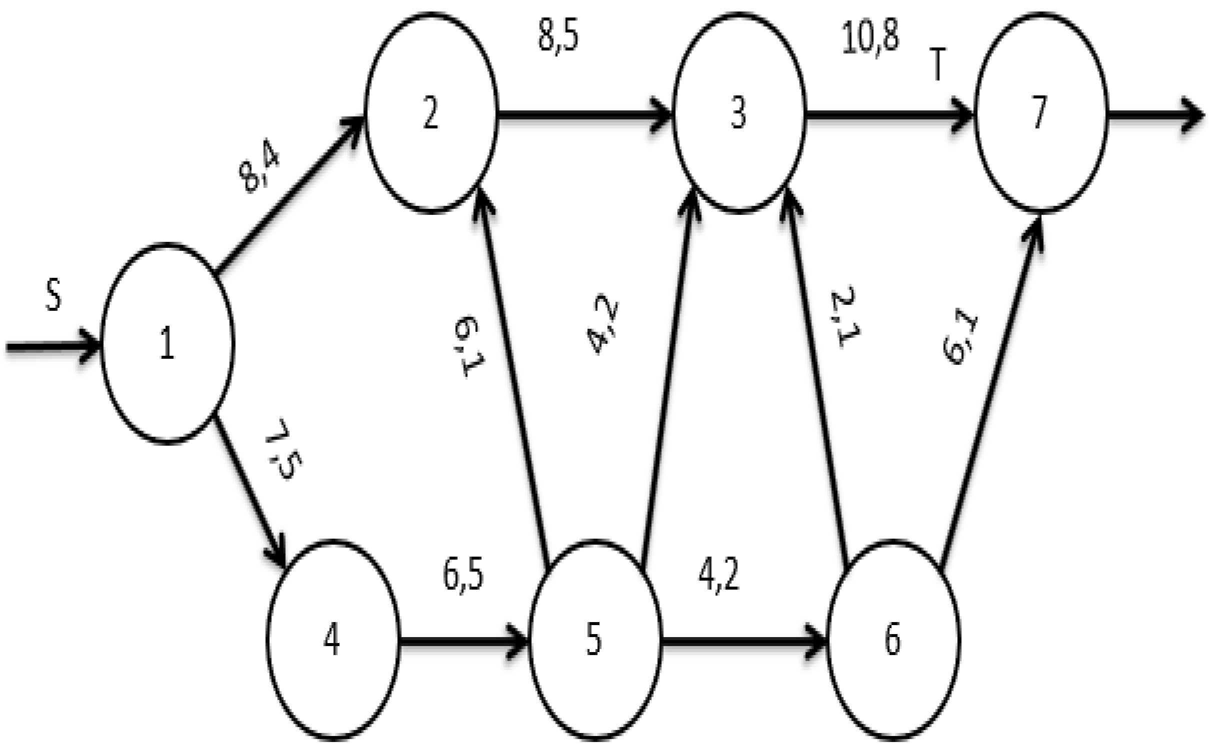
Q70:Find flow augmenting paths



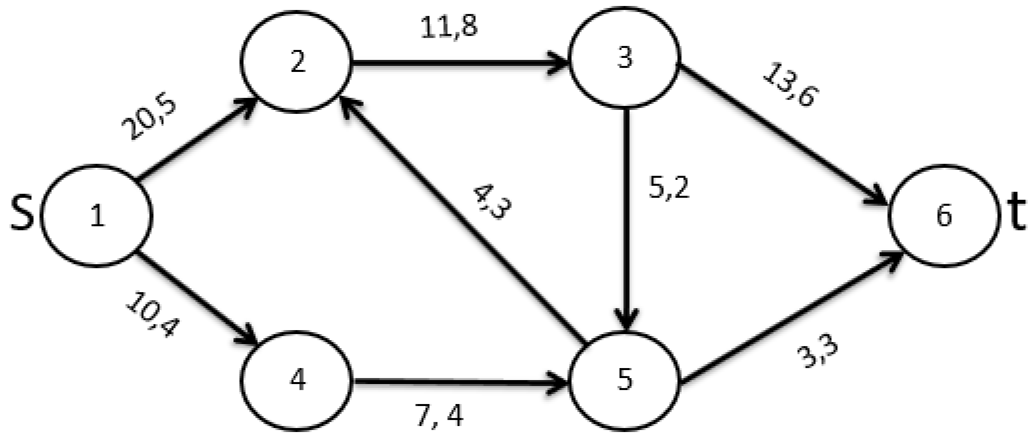
Q71:Find flow augmenting paths



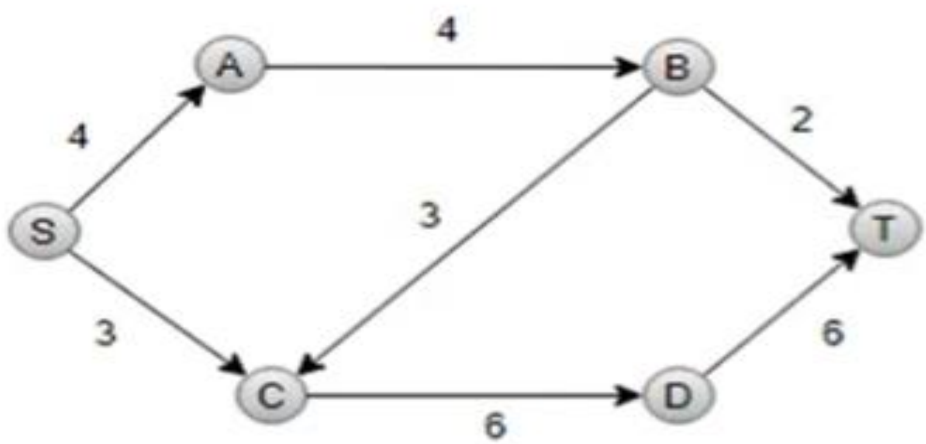
Q72:Find flow augmenting paths



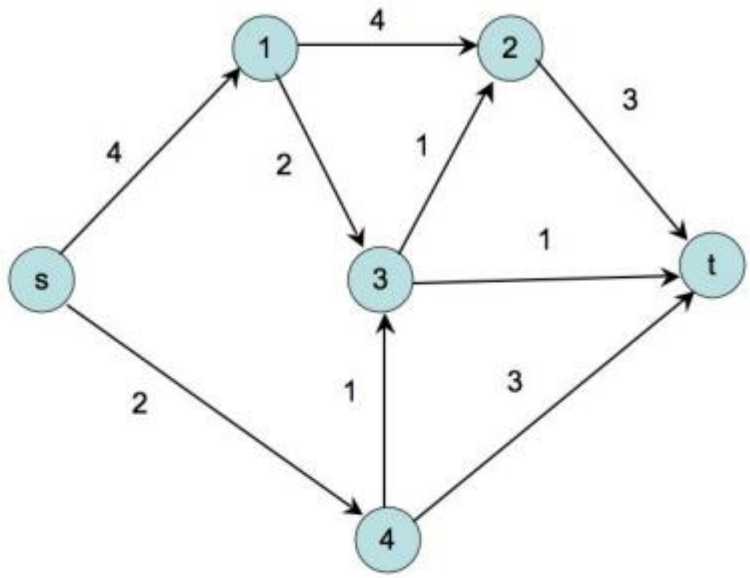
Q73:Find flow augmenting paths



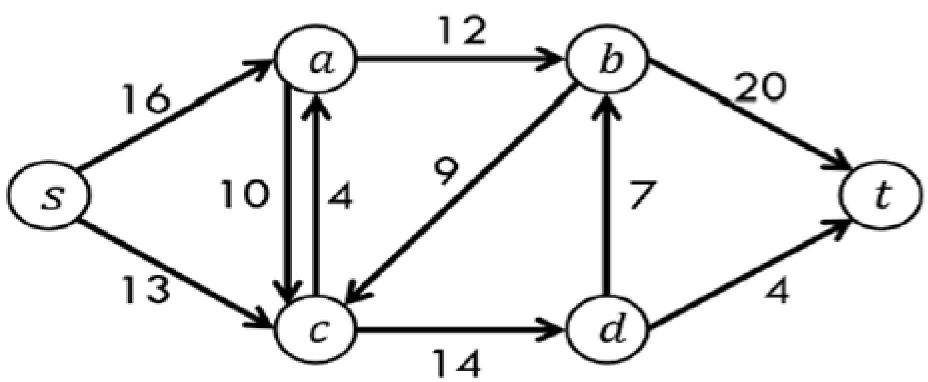
Q74:calculate max flow and residual flow in the following net work using Ford Fulkerson Method



Q75:calculate max flow and residual flow in the following net work using Ford Fulkerson Method

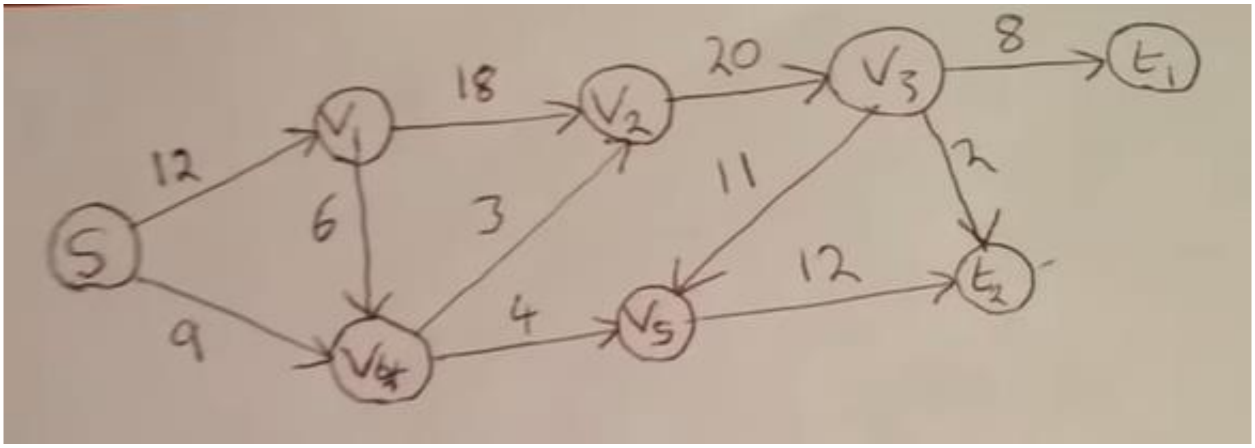


Q76:calculate max flow and residual flow in the following net work using Ford Fulkerson Method

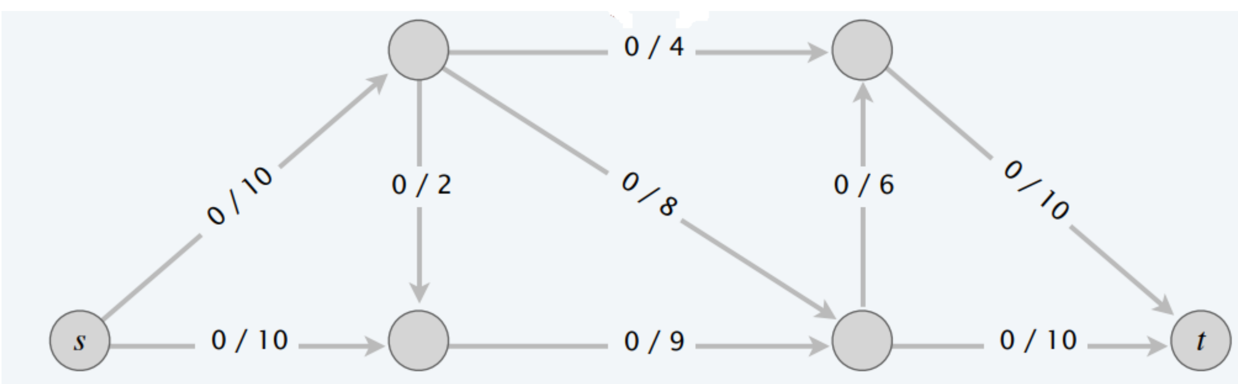


Q77:calculate max flow and residual flow in the following net work using Ford Fulkerson Method

Q78:calculate max flow and residual flow in the following net work using Ford Fulkerson Method



Q79:calculate max flow and residual flow in the following net work using Ford Fulkerson Method



Q80:calculate max flow and residual flow in the following net work using Ford Fulkerson Method