Engineering optimization

Assignment - II

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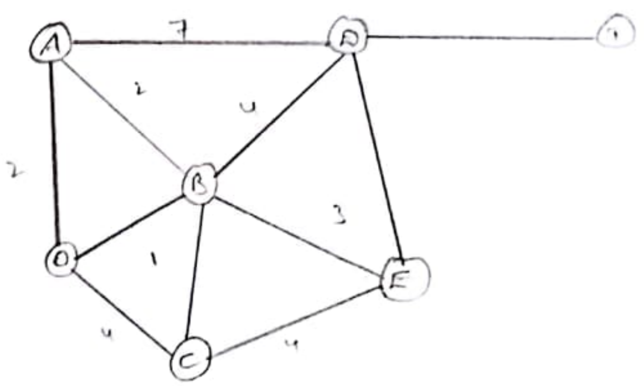
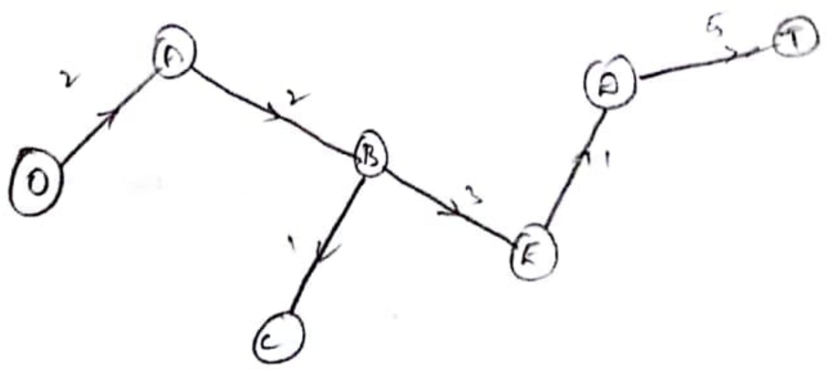
① Example of minimal spanning tree

A Company needs to determine under which roads telephone lines should be installed to connect all stations with a minimum total length of line.



① select any node arbitarily and then connect it to the nearest distinct node.

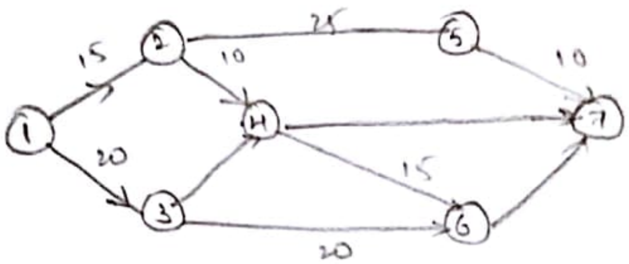
② Identify the connected nodes that is called to a connected node and then connect these two nodes untill all nodes have been calculated.



(3) The breaking ties for the nearest district node or the closest unconnected node may be algorithm must still an optimal solution.

(4) However such ties are signal that there may multiple optimal solution all such optimal can be identified by pursuing all ways of breaking ties to their conclusion.

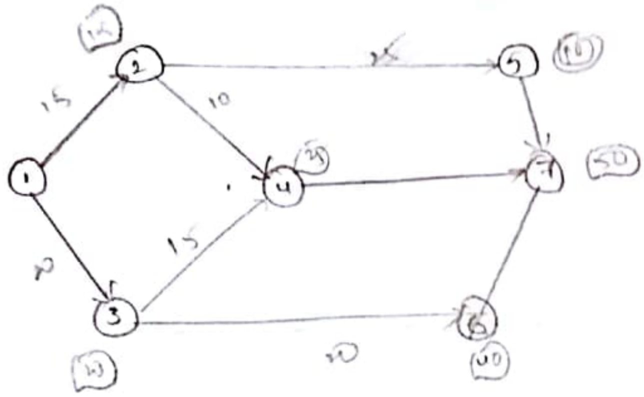
(2) Explain of DIJKSTRA algorithm, find the shortest route for the below freedia.



Sol The minimal shortest Algorithm route is similar to the minimal spanning.

In minimal spanning algorithm edge or distance to the next mode is minimised from current node while shortest route algorithm the distance to the next node from starting node.

From	1	2	3	4	5	6	7
1	1	15, 1	20	∝	∝	∝	∝
2	2	15, 1	20, 1	25	40	∝	∝
3	3	15, 1	20, 1	25, 1	40	40	∝
4	4	15, 1	20, 1	25, 1	40	40	55
5	5	15, 1	20, 1	25, 1	40, 1	40	~~50~~ 50
6	6	15, 1	20, 1	25, 1	40, 1	40, 1	50, 1
7	7	15, 1	20, 1	25, 1	40, 1	40, 1	50, 1



① ← ② ← ④ ← ⑦ = 50

(3) A brief note on the following (1) simulated annealing

(2) Genetic algorithm

(1) simulated annealing:

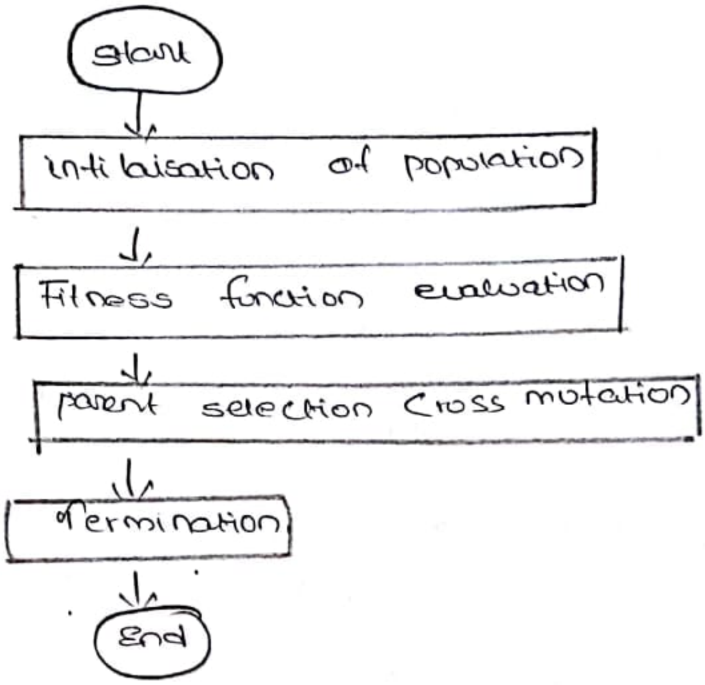
it is a prablistic technique for approximating the global optimum of a given function, specifically is meta heurstic to approximate in a large search space. it is often used when ~~used the search~~ space global optimum is more important than finding a precise local optimum in a fined amount a simulated may be prefeble to attentive such a gradiant desert.

Simulated annealing are of the most techniques available for solving hard combinated problems the main advantage of simulated annealing of that conditions if differential continuity and that one normally in conventional optimisation method.

(2) Genetic Algorithm:

A simple genetic algorithm process is illustrated in following after an intial population is randomly (or) heurstically produced the fitness function of the population is evaluated and the genetic.

algorithm involves the population through segential and interactive application motation a new generation is formed at the end of each interaction.



① Individual : carrier of the genetic information it is characterised by its state in the search space its fitness objective function values.

② population :
Pool of individual which allows the application of genetic operations.

③ fitness function : The terms fitness function is often used as a synoms for objective function.

④ Generation : Time unit of the GA on iteration on evaluating algorithm.

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(4) For the project represented by network shown in fig the estimates are stated in table determine probability that the different nodes of the realise decay.

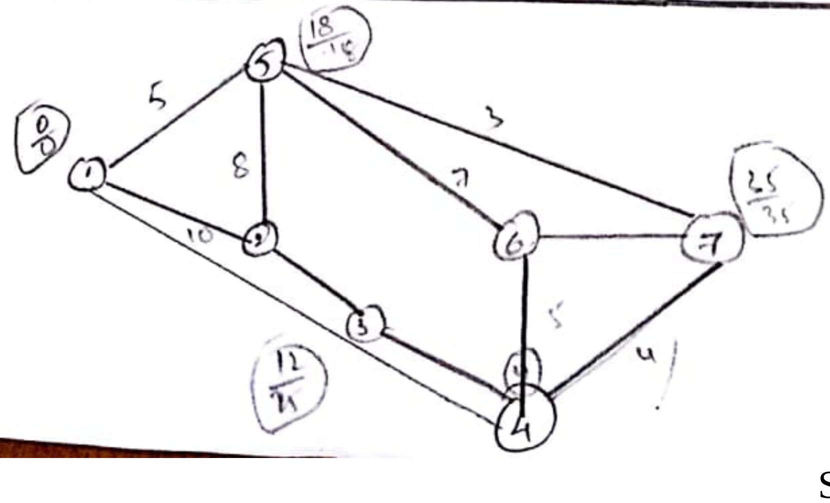
Sol:

W.K.T

Avg time $n = \frac{a+4m+b}{6}$

Variance $v = \left(\frac{b-a}{6}\right)^2$

Activity	a	m	b	D	V	
1 - 2	5	6	8	10	0.25	
1 - 4	1	3	4	1	0.25	
1 - 5	2	4	5	5	0.25	
2 - 3	4	5	6	9	0.111	
2 - 5	7	8	10	08	0.25	
2 - 6	8	9	13	10	0.694	
3 - 4	5	9	19	3	5.49	
3 - 5	3	4	15	4	0.111	
4 - 6	4	8	10	5	1	
4 - 7	5	6	8	4	0.25	
5 - 6	9	10	15	7	1	
5 - 7	4	6	8	3	0.44	
6 - 7	3	4	5	3	0.444	
				8	0.111	



Thus the mean duration of project $= 35$ [10+9+3+5+8]

The variance of duration of project = sum of variance of ~~duration~~ activities on the critical path $= 10.10$,

Thus $P =$ (project will be completed within days)

$$P(T \le) = P\left(\frac{T - t(T)}{\sqrt{v(T)}} \le 23.2\right)$$

(5) maximise

$3x_1 + 4x_2$

$\frac{2}{5}x_1 + x_2 \le 3$

$\frac{2}{5}x_1 - \frac{2}{5}x_2 \le 1$

$x_1, x_2 \ge 0$ are integer

Sol

$z = 3x_1 + 4x_2$

$\frac{2}{5}x_1 + x_2 + s_1 = 3 \rightarrow (1)$

$\frac{2}{5}x_1 - \frac{2}{5}x_2 + s_2 = 7 \rightarrow (2)$

$z - 3x_1 - 4x_2 - 0s_1 - 0s_2 = 0 \rightarrow (3)$

	z	x_1	x_2	s_1	s_2	sol	ratio
z	1	-3	-4	0	0	0	—
s_1	0	2/5	1	0	3	3	3
s_2	0	2/5	-2/5	0	1	7	-35/2

Step - II :

	z	x_1	x_2	s_1	s_2	sol	ratio
z	1	$-7/5$	0	4	0	12	-
x_1	0	$2/5$	1	1	0	3	3
s_2	0	$10/25$	0	$2/5$	1	$41/5$	→

Step - III :

	z	x_1	x_2	s_1	s_2	s_3	sol
z	1	0	0	5	$5/2$	0	$162/5$
x_2	0	0	1	$5/7$	$25/14$	0	$-99/35$
x_1	0	1	0	$5/7$	$25/14$	0	$204/14$
s_3	0	0	0	$-5/7$	$-25/14$	1	$-4/7$

	z	x_1	x_2	s_1	s_2	s_3	sol
z	1	0	0	5	$5/2$	0	$162/5$
x_2	0	0	1	$5/7$	$25/14$	0	$-99/35$
x_1	0	1	0	$5/7$	$25/14$	0	$204/14$
s_3	0	0	0	$-5/7$	$-25/14$	1	$-4/7$ →
$\theta = z/s_3$	-	-	-	-7	$-7/5$	0	$-\frac{567}{10}$

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	Z	x_1	x_2	S_1	S_2	S_3	Sol
Z	1	0	0	4	0	7/5	158/5
x_2	0	0	1	0	0	1	-17/5
x_1	0	1	0	0	0	0	14
S_2	0	0	0	20/5	1	-14/35	8/35

Step - IV

$$x_1 + 5/7\, s_1 + 25/14\, s_2 = \frac{204}{14}$$

$$x_1 + 5/7\, s_1 + 25/14\, s_2 = 14 + 4/7$$

$$5/7\, s_1 + 25/14\, s_2 \geq 4/7$$

$$5/7\, s_1 + 25/14\, s_2 - s_3 = 4/7$$

Then the solution for the given maximise function are

$$x_1 = 14$$

$$x_2 = -17/5$$

$$Z = 158/5$$