Midterm – Metaheuristics (10 questions)

1. Find the optimal route for the TSP problem given below. Use any trajectory based search technique

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| city | 1 | 2 | 3 | 4 | 5 |
| 1 | 0 | 132 | 217 | 164 | 58 |
| 2 | 132 | 0 | 290 | 201 | 79 |
| 3 | 217 | 290 | 0 | 113 | 303 |
| 4 | 164 | 201 | 113 | 0 | 196 |
| 5 | 58 | 79 | 303 | 196 | 0 |
|  |  |  |  |  |  |

2) Solve the assignment problem. 4 jobs and 4 machines. Each job must go on to a single machine. Objective is to minimize total set up time. Table below gives setup times. Initial solution job 3124 to machine 1 2 3 4 respectively. Use any trajectory based search method.

Job 1 job 2 job 3 job 4

Machine

1 8 5 8 7

2 2 12 5 3

3 7 8 3 9

4 7 5 6 7

3) Minimize f(y) = y12-2y2 + 6y1y2 using a binary representation of length 5. 0<=y1, y2<=2. Select your own initial solution. Use Tabu search with Tabu list of length 2 and Tabu tenure of 1

4) For a 2 machine flow shop (jobs flow from machine 1 to 2), and total weighted tardiness as the objective to be minimized, find a schedule.

* Apply the ATC heuristic with K=1

Jobs j 1 2 3 4 5

pj 13 9 13 10 8

dj 6 18 10 11 13

wj 2 4 2 5 4

5) For problem 4) apply any trajectory based local search. Compare your answers with ATC.

1. Apply the shifting bottleneck heuristics with and without resequencing, and with the objective to minimize maximum completion time.

Jobs m/c seq pij

1 1 2 3 4 p11=9, p21=8, p31=4, p41= 4

2 1 2 4 3 p12=5, p22=6, p42=3, p32 = 6

3 3 1 2 4 p33=10, p13=4, p23=9, p43 =2

Draw the Gantt chart

1. A truck must serve cities within a radius of 20 miles from its garage. For the data in miles between cities given below, determine the minimum number of trucks to purchase and where to garage them

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| city | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 | 0 | 10 | 20 | 30 | 30 | 20 |
| 2 | 10 | 0 | 25 | 35 | 20 | 10 |
| 3 | 20 | 25 | 0 | 15 | 30 | 20 |
| 4 | 30 | 35 | 15 | 0 | 15 | 25 |
| 5 | 30 | 20 | 30 | 15 | 0 | 14 |
| 6 | 20 | 10 | 20 | 25 | 14 | 0 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 3  2  4  1  1  3  1  1  2  6  3  3  2  1  3  4  2  3  4  3 |  |  |  |  |  |

Solve the above capacitated min spanning tree from the root using GRASP. Max capacity is 6.

1. Consider a flexible flow shop with 3 stages. Stage 1 has 1 machine and stage 2 and 3 have 2 machines each. There are 6 jobs in the MPS. Let pkj’ denote processing time at stage k, k=1,2,3. Schedule the jobs for this flow shop and obtain a Gantt chart.

Jobs 1 2 3 4 5 6

P1j’ 3 1 6 3 5 4

P2j’ 2 3 1 6 2 3

P3j’ 4 6 5 3 2 1

1. Question 6.2 page 138 of text.