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Comparison Method of Solving Travelling Salesman Problem

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***Abstract*—The "branch and bound" algorithm can be used for solving the traveling salesman problem. The set of all cities (feasible solution) is broken up into increasingly small subsets by a procedure called branching. For each subset a lower bound on the length of the cities there in calculated..Eventually a subset is found which contain a single city whose length is less than or equal to some lower for every cities the motivation of the branching and the calculated of the lower bounds are based on ideas frequently used in solving assignment problem .The time taken to visit all the cities and return back to the hometown has been consider as an important factor and by using the branch and bound method to tsp problem reduce the time in micro seconds when compared to other tsp algorithm the (BB)Branch and Bound provides the better method of searching.**

***Keyword*: Lower bound, BB-Branch and Bound.**

I. INTRODUCTION

The Travelling sales man problem is easy to state: A salesman begins at one city, needs to visit each of (n-1)other cities and return back to the starting city. In order to visit all the cities to minimize the total distance traveled. We can substitute time, cost or other factor to measure of effectiveness as desired. Distance or cost between all the cities is perfumed known. The difficulty is entirely computational, since a solution obviously exists. There is (n-1)! Possible path, one or more of which must give city, one or more of which must give minimum cost.

A branch and bound algorithm is represented for solving the traveling salesman problem. The set of all tour is broken up into small subsets by proceeding of the branch and the calculation of the lower bound. The basic method will be to break up the set of all cities into smaller and smaller subsets and eventually identify an optimal tour.

When a subset is found that contain a single tour whose cost is less than or equal to the lower bounds for all other subsets, that is optimal. The subsets of cites are conveniently represented as the nodes of a tree and the process of partitioning as a branching of the tree.

Hence we have called the method "branch and Bound". The cost of the travelling salesman problem forms a matrix. Let the cities be indexed bye=1, nether entry in row I and column j of the matrix is the cost for city I to

City c=[c (I, j)] =cost matrix

C will start out as the original cost matrix of the problem but will undergoes various transformations as the algorithm lower bounds. A useful concept in
Constructing lower bounds will be that of reduction. Of a constant, h, is subtracted from each element of a row of the cost matrix, the cost of any tour under the new matrix is less than under the old. This is because every city must contain one and only one element from that row. The relative cost of the all cities is unchanged, however, and so any tour optimal under the old will be optimal under the new. The time taken to complete the shorted path form the starting city to all the n-1cities is calculated and reported in microseconds.

Genetic Algorithms (GAs) are adaptive heuristic search algorithm based on the evolutionary ideas of natural selection and genetics. They presented an intelligent exploitation of a random search developed to solve optimization problems. GAs are by no means random, instead they exploit historical information to direct the search into the region of better performance within the search space. Hybrid GA is used to find the quality solutions for TSP problems with lower computation complexity. MAX --MIN Ant System, is consider to enhanced version of basic Ant System, and report the results for its application to symmetric and asymmetric instances of Traveling Salesman Problem. MAX – MIN System can be significantly refined extending it with local search heuristics.

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II. LITERATURE SURVEY

The many similarities between server and Travelling Salesman Problem allotment, proposed a new decentralized travelling salesman algorithm which with dynamism allocates servers to give surety of request loads. The work is compared in opposition to a genetic algorithm computes the optimal static allocation.

They evaluated performance on simulated request streams and commercial trace data. The algorithm shows better result than static or greedy for highly variable request loads, but greedy can outperform the method under low changeability. A number of results were developed by Chandra and some worst case and some probabilistic, on the performance of and k opt local search for the TSP with respect to both the quality of the solution and the speed with which it is obtained. One of the most effective methods for giving optimal or near optimal solutions for the symmetric TSP is described Computational tests show that the implementation is highly valuable.

The study is based on the analysis of numerical results obtained by systematically applying the Travelling Sales Man algorithm to a more than cities TSP. The prospect and the variance of the cost are analyzed as a function of the control parameter of the cooling schedules the fastest TSP solution method; it is widely recognized as a performance benchmark.

The combination of local search heuristics and genetic algorithms is a capable approach for finding near optimum solutions to the traveling salesman problem (TSP). An approach is offered in which local search techniques are used to find local optima in a given TSP search space, and genetic algorithms are used to search the space of local optima in order to find the global optimum. In thisutilized new genetic operators for realizing the proposed approach are described, and the quality and efficiency of the solutions obtained for a set of symmetric and asymmetric TSP instances are discussed.

The stratagem of the algorithm is to broaden the successful results of a genetic algorithm (GA) using a distance preserving crossover (DPX) by including memory in the form of ant pheromone during the city selection process. The synergistic combination of the DPX-GA with city selection based on probability found out by both distance and previous success adds additional information into the search mechanism.

This combination into a Hybrid GA facilitates finding quality solutions for TSP problems with lower computation complexity. MAX --MIN Ant System, an enhanced version of basic Ant System, and report the results for its application to symmetric and asymmetric instances of Traveling Salesman Problem. MAX –MIN System can be significantly refined extending it with local search heuristics.

The results show that MAX --The approach proposed by Travelling Salesman algorithm based on the intellectual behavior. In this work, TSP algorithm is used for optimizing multi variable functions and the results produced by TSP better than Genetic Algorithm (GA).

III. BASIC THEORY OF TRAVELLING SALESMAN PROBLEM

Traveling Salesman Problem (TSP) is about finding a shortest path with minimum cost. Travelling salesman problem (TSP) finds its application in many real world industrial applications including the areas such as logistics, transportation, and semiconductor industries.

Few potential applications of TSP includes finding an optimized scan chains route in integrated chip testing, parcels collection and sending in logistics companies, and transportation routing problem. This paper gives a brief overview of the various approaches that have been implemented to solve TSP and specifically bee Lower Bound Based (LBB) for solving TSP. The LBB model is constructed algorithmically based on the collective intelligence shown in bee foraging behavior.

Assume that a salesman is given a set of cities along with traveling distances (or costs) from one city to another city. The salesman is obligatory to explore each city (while traveling the salesman must visit every city only once and then return to the starting city) with least distances (or costs). The outcome of TSP is to conclude a Hamiltonian tour with minimum cost.

TSP can be denoted via graph notations as follows:

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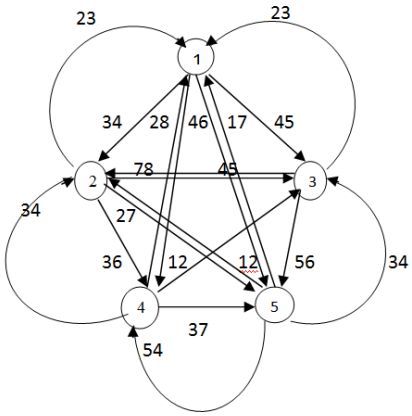

Fig 1:TSP with 5 cities

Let n is the number of cities. imp is the using cost matrix and cost list To address the a[I][j] get the Cost Matrix Value minces(city) and then city is a visited number of cities to increase the city range city+1 city=least(city).General approach to solve least cost of a TSP problem is shown below.

```
for(i=0;i <n;i++)
{
        if((a[c][i]!=0)&&(visited[i]==0))
                if(a[c][i] < min)
                {

min=a[i][0]+a[c][i];
                        kmin=a[c][i];
                        nc=i;
                }
}

if(min!=999)
cost+=kmin;
returnnc;
```

ncity to validate number of city cost

cost +=a[city[ncity]

Return the Miminum cost of ncity and get the time using cputime.

cputime = (double)(endtime - starttime) / 1000.0 /CLOCKS_PER_SEC;

In this work, TSP algorithm is used for lower bound cost multivariable functions and the results produced by LBB, Travelling saleman Algorithm (TS) results showed that outperforms the other algorithms. Traditionally, chess has been called the "fruit fly of Artificial Intelligence".

In recent years, however, the focus of travelling cost research has gradually shifted away from chess towards travels that offer new challenges highlighted. These challenges consist of large branching factors and imperfect information. The key ideas about TSP are presented in the approach.

IV. COMPARISION OF GA AND BB OF SOLVING TSP

1. A model of TSP problem with 5 cites and cost of transportation is given below:

0	34	45	46	12
23	0	45	36	27
23	78	0	45	56
28	34	12	0	37
17	18	34	54	0

2. The model is solved by GA and Branch &Bound(BB) methods to compare the performance in terms of time.

The genetic algorithms are a capable approach for finding near optimum solutions to the traveling salesman problem (TSP). An approach is offered in which local search techniques are used to find local optima in a given TSP search space, and genetic algorithms are used to search the space of local optima in order to find the global optimum. In this Mars utilized new genetic operators for realizing the proposed approach are described, and the quality and efficiency of the solutions obtained for a set of symmetric and asymmetric TSP instances are discussed.

The synergistic combination of the DPX-GA with city selection based on probability found out by both distance and previous success adds additional information into the search mechanism.

This combination into a Hybrid GA facilitates finding quality solutions for TSP problems with lower computation complexity. MAX --MIN Ant System, an enhanced version of basic Ant System, and report the results for its application to symmetric and asymmetric instances of Traveling Salesman Problem. Hoops show how MAX –MIN Ant System can be significantly refined extending it with local search heuristics.

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The results show that MAX – MIN Ant System has the property of effectively guiding the local search heuristics towards promising regions of the search space by generating good initial tours. Seeley et al. studied the extent to which scout honey bees gain information from waggle dances the whole time their careers as foragers.

TABLE 1.GA SOLVINGTSP

S. no	No. of Cities	Time consuming in seconds
1	5	2.07
2	10	2.14
3	25	2.31
4	50	2.63

The Cost matrix of GA algorithm:

0	34	45	46	12
23	0	45	36	27
23	78	0	45	56
28	34	12	0	37
17	18	34	54	0

The path is:

1→5→4→3→2→1

Minimum cost : 179

Time elapsed in second: 2.07

Figure 2: Genetic Algorithm TSP

The Travelling Salesman Algorithm used to fnd short path for cost wise and easily to get the cost reduction. This types of algorithm used lower bound cost base travelling process. Easily to get the minimum cost path area and the time-consuming has been give it. The algorithm uses an efficient neighborhood structure to search for reasonable solutions and iteratively progress on prior solutions.

The primary solutions are generated using a set of priority dispatching rules. Experimental results comparing the proposed TSP used LBB approach travelling problems are presented.

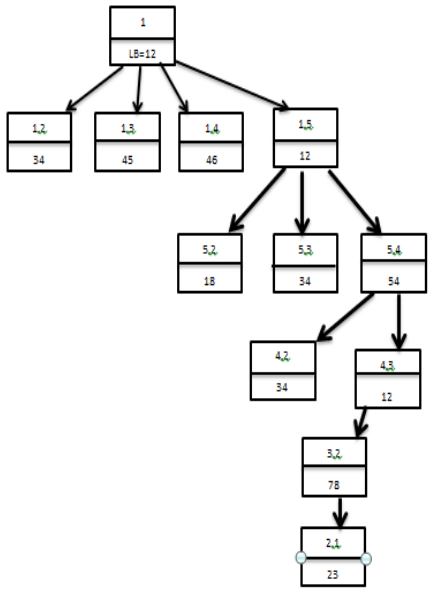

TABLE 2. BB SOLVING TSP

Sno	No of Cities	Time-consuming in seconds
1	5	0.05
2	10	0.10
3	25	0.25
4	50	0.50

The Cost matrix of B&B of TSP

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0	34	45	46	12
23	0	45	36	27
23	78	0	45	56
28	34	12	0	37
17	18	34	54	0

The path is:

1→5→4→3→2→1

Minimum cost :179

Time elapsed in second: 0.05

Figure 4: Branch and Bound TSP

V. RESULT AND DISCUSSION

The stratagem of the algorithm is to broaden the successful results of a Travelling Salesman algorithm (TSA) using a distance preserving crossover (DPX) by including memory in the form of ant pheromone during the city selection process. The synergistic combination of the DPX-GA with city selection based on probability found out by both distance and previous success adds additional information into the search mechanism. This combination into a Hybrid Lower Bound facilitates finding quality solutions for TSP problems with lower computation complexity.

MAX --MIN TSP System, an enhanced version of basic TSP System, and report the results for its application to symmetric and asymmetric instances of Traveling Salesman Problem.MAX –MIN TSP System can be significantly refined extending it with local search heuristics. The results show that MAX --MIN Ant System has the property of effectively guiding the local search heuristics towards promising regions of the search space by generating good initial travel.

The genetic algorithm to combine the TSP Algorithm, the genetic algorithm use to travelling area high, The return the time complexity at seconds it generally takes more than one seconds. But the traveling salesman using Branch and Bound will the return the result in less than one second. Hence the Branch and Bound method is considered to be better method of solving the TSP.

VI. CONCLUSIONS

This paper presents a glance of various approaches being used to solve TSP. The Lower bound is highlighted for Travelling Salesman problem with its basic mechanism of bees foraging behavior and its efficiency in solving shortest path among various cities and various cost and time consuming. The useful concept to constructing the lower bounds will be that of reduction. TSP problem is compared with Genetic algorithm of TSP in order produce the efficient result in terms of time. Hence the Branch and Bound method of TSP produce lower time taken to solve the problem and it is consider to be the better method of solving TSP problem.

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