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Genetic Algorithms Based Approach to Solve 0-1 Knapsack Problem Optimization Problem

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ABSTRACT: In this paper, we solve 0-1 knapsack problem using genetic algorithm. The knapsack problem is also called the NP (non deterministic polynomial) problem. We have to maximize the profit value that can be put in to a knapsack under the confinement of its weight. Solve the knapsack problem and also show its possible and effectiveness crowd an example. The Genetic Algorithm uses corrupted renewal and focal improvement operators which are applied to every recent generated solution. Results show that most of the time the new Genetic Algorithm tend to the same point much faster to more appropriate results in particular for large problems. Genetic Algorithms are search approach based on natural selection and natural genetics. They erratically construct early residents of exclusive. They use genetic operators to concede offspring.

KEYWORDS: Genetic; Algorithms; Knapsack Problem; load; price; and Optimization; difficulty

I. INTRODUCTION

The knapsack problem is a traditional difficulty of involvement and optimization, and has a set of application for budgeting, project, choice pick of items, material, and cost-effective development. Knapsack problem is also NP (Non-deterministic problem) hard problem, and has been deep studied. Genetic algorithms are beneficial at select large potential huge, search space and navigating them see for best collection of things and results which we not determine in a life. If the polynomial is the classes of decision problem, that are also resolve by algorithms that are sprint in the time polynomial in the length of the input string or guessing the solution. Genetic Algorithm is a computerized search technique and optimization algorithms based on artisan of natural genetics and natural selection methods, are proposed based on Darwin's. Professor HOLLAND of university of Michigan Ann Arbor, the concept of genetic algorithms published (Holland 1975) [3]. GAs is also generate and find optimal and appropriate results which closer to the extract solution in the polynomial time.
There are three type of operation in Genetic algorithms: In a genetic algorithms there are two types of selection function are used, roulette-wheel and group selection, crossover, and mutation [8]. There are three type of crossover used in this research paper: One bit crossover, two bit crossover, and three bit crossover. The problem is to fill the knapsack with select some minimum weight of item whose total weight of the item does not exceed the capacity, the total profit of the knapsack is maximum.

II. GENETIC ALGORITHMS

Genetic algorithms are more brilliant at pleasing large, explore and inherent, and map-reading them found for maximize association or mixture compound of thing and outcome, which are capability not locate in a life time .Genetic algorithms are also design search space and dynamic programming (DP) accomplishment for a large amount of conventional exploit technique [1]. We have produced many designs at a time, and improve search algorithms.

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Genetic algorithms are a searching and maximize real time function algorithms. The method of finished more proficient or quicker program through selection and design of data structure, algorithms and in sequence progression, similar than control based exploit techniques projected by Darwin.
It is better than conventional artificial intelligence in that it is more robust. They do not easily even if the inputs changed slightly, or in the attendance of logical sound [5]. Also, in penetrating a great condition-break, multi-modal state-space, or non dimensional surface, a genetic algorithms may offer significant benefits over more typical search of optimization techniques, such as linear programming, heuristic, depth-first, breath-first, and praxis.

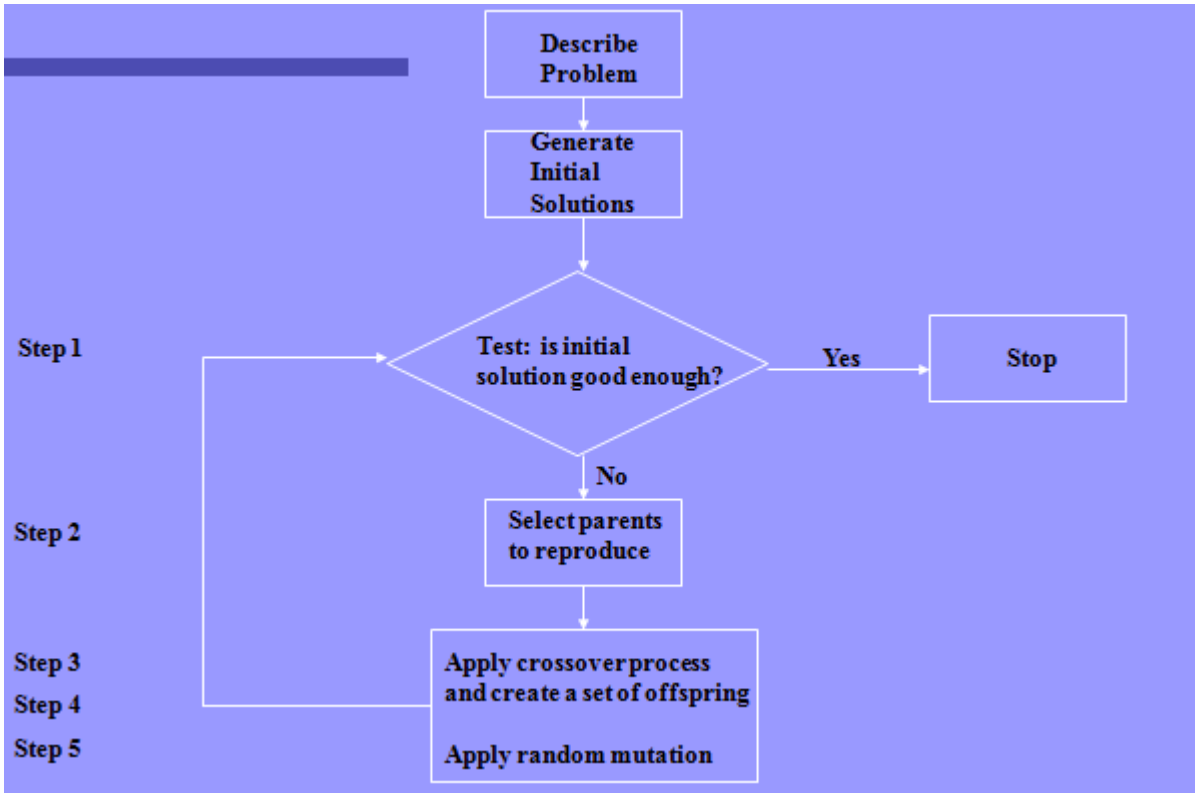

Fig 1: Flow Chart of Genetic Algorithms

The process of Genetics Algorithms is repetition based of constant population size of candidate results. In each production or formation/repetition each fitness value of chromosomes current population is compare and new population develop chromosomes with best fitness value [7].
A. Life Cycle of Genetic Algorithms based on:

- Population (chromosome)
- Evaluation (fitness)
- Selection (mating pool)
- Genetic operation

Genetic Algorithms the continued existence of the fittest among particular over continuous generation for solving a problem. Each generation consists of character string that is similar to the chromosome that we see in our DNA [9]. Each separate represents a point in a search space and a feasible solution. The single in the population are then made to through a process of unfolding.

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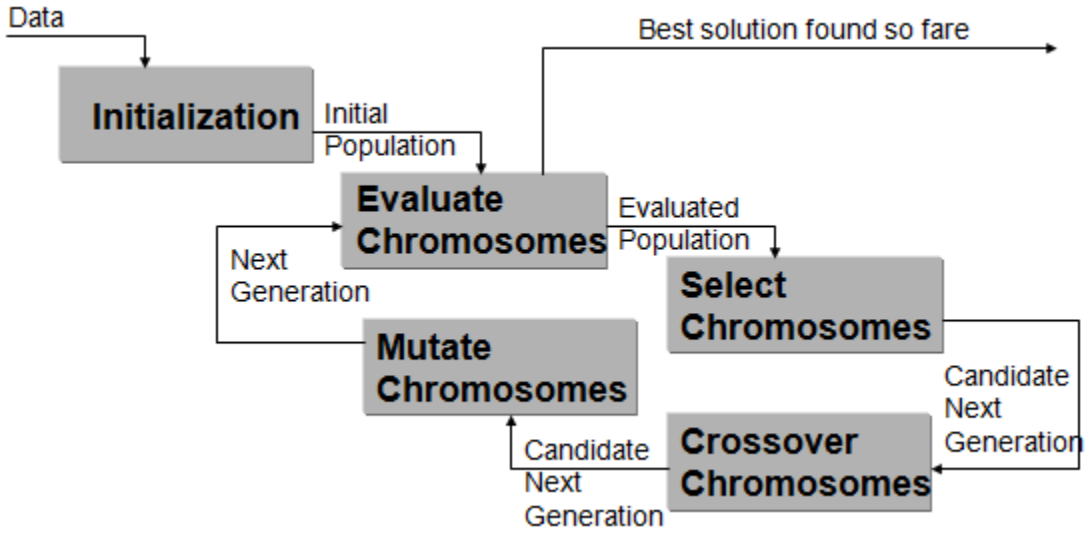

Fig 1.2: Process to find Best Solution

Search Space: A population of single is preserved thin search space for genetic algorithms, each show a possible solution to a given problem. Each single is coded is as a finite length vector of full quantity, or mutable, in terms of binary alphabet {0, 1} [12]. To permanent the genetic analogy these particular are likened to chromosome (solution) is composed of several genes mutable). A fitness score is assigned to each results how the abilities of separate to each solution show the efficiency of separate to complete the single with the best (or generally near optimal) fitness incision is sought. The Genetic Algorithms aims to use selective instruction of the solution to bring offspring better than the show by mixed intelligence from the chromosome.

The Algorithms:

Step 1: Randomly initialize population(x)
Step2: Find fitness of population(x1)
Step3: Repeat
Step4: Select presents from population(x)
Step5: Perform crossover on grant creating population(x+1)
Step6: Perform mutation of population(x+1)
Step7: Find fitness of population(x+1)
Step8: Until best particular is good enough

III. IMPLEMENTATION DETAILS

Based on natural selection method:
After represent population is randomly produce, the algorithms evolve the through three operators:

- collection which equates to continued existence of the fittest
- Crossover which represents mating between particular
- Mutation which present random modify

A. *Selection operator*:

Selection process is also used after the fitness function this also dependent on the fitness value. The value of fitness is optimal then select for reproduction, if the value of the fitness is less optimal the chromosome is not selected [13]. Optimal fitness value of the chromosome is selected several times for reproduction further applied the different crossover and mutation method [14]. Elitism is also improved the performance of the selection method, and optimize the genetic algorithms. Selection method can be simulated using the fitness value of chromosome of the input. We have to calculate the probability of the selecting of the string in selection method. There is following selection method for selecting the fitness value from the parents to the crossover.

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The fitness functions are also defined over the genetic exhibit and estimate the quality of the show results. The fitness function is always problem minion. For instance, in the knapsack problem one wants to optimize the total value of goal that can be put in a knapsack of some variable capacity [11]. A show of a result might be an array of bits, where each bit show a different goal, and the value of the binary bit (0 or 1) show whether or not the final goal is in the knapsack [1]. Not every such exhibit is valid, as the size of goal may outdo the capacity of the knapsack. The results are the sum of price of all objects in the knapsack if the show is efficient.

B. Crossover Operator

Crossover is also applied after the reproduction phase in mating pool to propose a good string [6]. The data store in the parents string that search parameter space because impulse of better string made under reproduction. In crossover method we have to exchange the bit one passion to another passion by different crossover methods, and find optimal solution for population.

- Single site crossover
- Two-point crossover
- Multi-point crossover
- Uniform crossover
- Two dimensional
- Cross over rate

- Cost indicates by a mark factor of genetic algorithms from other optimization techniques.
- Two exhibits are select from the population using the selection operator.

  A crossover site along the bit string is randomly chosen.

  The values of the two series are swap to this point.

  If P1=000111and P2=111111 and the crossover point is 2 then C1=110111 and C2=001111

  The two new formation created from this mating are put into the next generation of the population by merge the portion of good particular.

C. Mutation Operator

We have to take four bit for mutation is execute, it is may lead next result to feasible 1001 and then after mutation 1100 is the infeasible. Mutation alone holds a random walk through the search space.

Mutation is also applied after the crossover to avoid the occurrence of an event all result in the population into a local extreme of solve problem. The probability of the mutation Pm is 0.01% which to find number of bits to be muted, it mean the 10% of the chromosome in reproduction are selected or goes through for reproduction. Filling bits from 1to 0 or 0 to 1, and the new solution according to the fitness value from chromosome is called formation (offspring). The result of the coin flipping is optimal and to protect the diversity in the population to local extreme [14].

D. Termination

This production process is repeated until a termination condition has been reached. Common terminating conditions are:

- A result is build that fulfil minimum criteria
- Variable number of reproduction reached
- Allocated stock (calculation time/money) reached
- The maximum rate result fitness is goes or has reached a plain such that successive iterations no longer produce optimal results
- Manual examination
- Joint of the above.

E. *Elitism*

A skilled inconstant of the procreation process of build a new generation is to allow good organism (s) from the current population to carry over to the next, unaltered. This mythology is known as selective selection and warrant that the result excellence obtains by the GA will not reduce from one design to the after that.

Effects of Genetic Operators**:**

- Using collection alone will tend to fill the residents with copies of the finest personality from the residents
- Using assortment and intersect on a good but sub-optimal result

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- Using s mutation alone comprises arbitrary walk through the search space.
- Using assortment and mutation build equivalent, hill climbing algorithm.

IV. KNAPSACK PROBLEM

Knapsack problem consider an optimal solution. 0-1 knapsack problem can not solved by greedy method because it is not fill the capacity of knapsack and empty quantity lower the effective value per pound of the load, and we must estimate the solution to the sub problem in which the item is exclude before we can make the dainty [7].
Fractional knapsack problem is also solved by greedy method because the 0-1 problem is not. The aim to fill the knapsack, the total weight of each item does not exceeded the capacity of knapsack, and maximized the total profit of the contain objects [9]. Each items having a weight and profit of item pi and capacity of knapsack C. In this problem, the problem is called 0-1 problem because each item has been taken receive or ignore. The value of xi will be 1 if the item has been taken in the knapsack. If the value of xi will be 0 if the item has been ignore or not selected in knapsack.0-1nknapsack problem is also known a binary value and also represent a vector value.

Condition is

$$\sum_{i=1}^{n} wixi \ll C \qquad (1)$$

And subject to restrain and total profit maximize (1≤i≤n)

$$\sum_{i=1}^{n} pixi \qquad (2)$$

Given a knapsack with highest competence W, and a set S consisting of n items Each item it has some weight wi and profit value bi (all wi, bi and W are integer values) Problem: How to pack the knapsack to get greatest total value of filled things.
The knapsack problem or backpack crisis is a problem in arrangement optimization given a set of piece, equally with a lightness and a value, conclude the number of each item to take in a set so that the total load is less than or equal to a given limit and total value is as large as feasible.
Maya Hristakeva and Dipti Shresthna proposed the implementation of the 0-1 knapsack problem using the Genetic Algorithms. We have to find the optimal solution of the knapsack problem, and implementation of two function roulette-wheel function and selection function for solving the problem. In this paper the results are depends on the Elitism. Elitism is also improved the performance of the roulette-wheel function [10]. We have to define the basic idea and implementation of the genetic algorithms to solved the0-1 knapsack problem, and tested the program different cross cover ratio than select the optimal population. The selection and roulette wheel, mutation method are used to select the optimal population in new generation. Mutation is also preparing the genetic algorithms to the local and end of the operation. The probability of the mutation is 0.10 mean 10% of the chromosomes will select for reproduction. In this paper the Genetic algorithms can be used and find the good solution for knapsack problem with selection function and roulette wheel function [4]. Elitism is method very important for find the optimal and accurate solution of the genetic algorithms

V. SIMULATION RESULTS

Future effort has been implementing in MATLAB R2009b and replication is performing many periods and outcome were analyze. Here we explain one of the research and its outcome

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The measured knapsack problem is:

Object	Efforts	wt
A	48	8
B	15	4
C	46	5
D	28	6

Table 1.1: Measure Knapsack Problem

Ability of given knapsack is 10.
The evaluation of outcome is exposed in table under

Point of Compa	Convention al	Proposed GA
Set	[0 0 1 1]	[0 0 1 1]
Value of	6	6
Weight of	1	1
Computation Time	2.96 Sec	0.28 Sec
Iteration	1	3

Table 1.2: under viewing the junction of equally Genetic Algorithms:

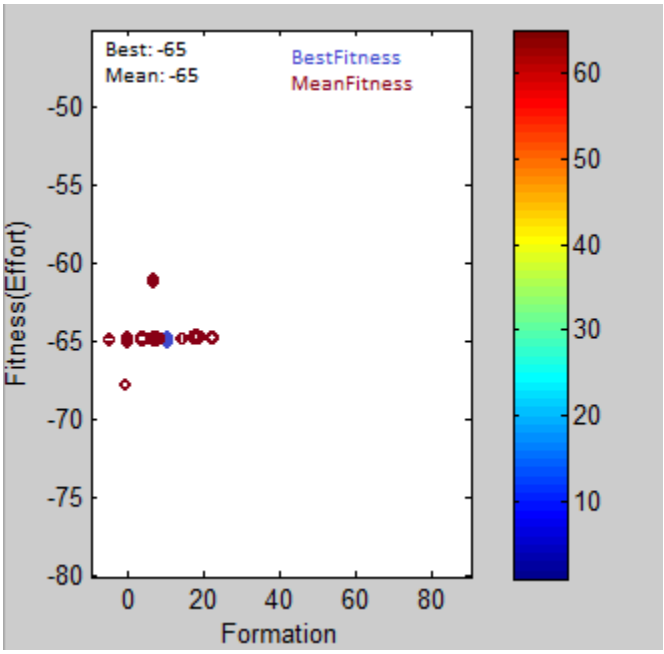

Fig. 2.1: Junction of predictable Genetic Algorithms

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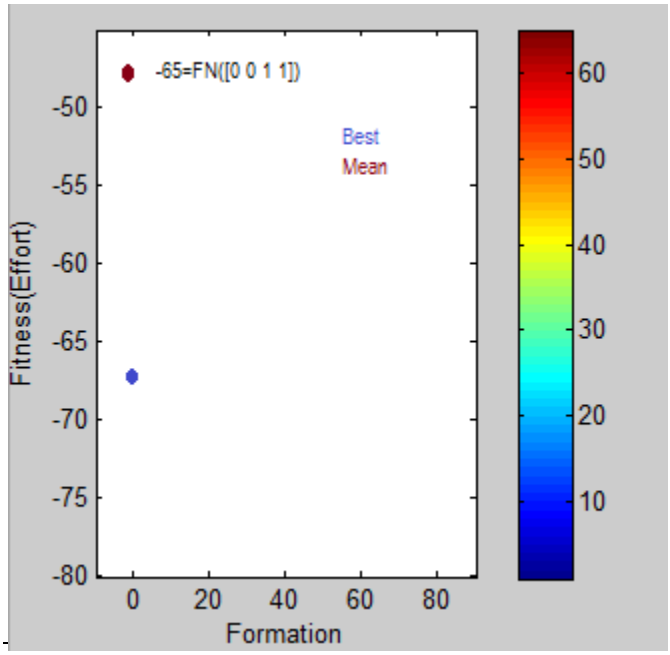

Fig.2.2: junction of proposed Genetic Algorithms

VI. Conclusion and Future Work

Genetic algorithms appear to find the optimal solution for solving 0-1 knapsack problem. Genetic algorithm for the 0-1 knapsack problem and literature study shows that these operations are very helpful to find optimal solution in less time. One feature that we planning to add in this paper in near future is to incorporate a good search technique to the genetic algorithms, which may find optimal solution for 0-1 knapsack problem in less generation and time. The simulation outcome showing that the projected algorithm performs improved with the whole program force metric than the highest amount of hop metric. The future algorithms provide force proficient corridor for facts broadcast and maximize the duration of total set of connections

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BIOGRAPHY

Veenu Yadav received B.Tech degree in department of computer science and engineering from Maharana Pratap engineering college, Kanpur, Approved by AICTE, New Delhi and Affiliated to Gautam Buddha Technical University (GBTU) Lucknow in 2013 and M.Tech Student in computer science and engineering from Amity University in Lucknow, Approved by AICTE and Accredited by National Assessment and Accreditation Council (NAAC) with A grade in 2016. Her research interests are Genetic Algorithms (GAs).