

# Applying Genetic Algorithm on Organization Business-oriented

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**Abstract—** Because of the successful work of Genetic Algorithm to find the best solutions, it was applied in order to find the best estimate engineering projects cost by collecting data and information about the cost of such projects, and then obtain the best estimate of the cost of the engineering projects at the discretion of the highest profit possible. In this paper Genetic Algorithm is used to implement an application to determine the optimal solution by a residential suburb consisting of a certain number of residential buildings and determine the optimum number of buildings depending on the amount of the cost and profit. Our results have shown that the used method presents a good accuracy of (86.66%).

**Keywords —** Genetic Algorithm, Civil Engineering Application, Chromosome, Fitness.

## I. Introduction

Genetic Algorithms have emerged in its current form in 1975 by John Holland at the University of Michigan, which developed in the early 1980s to become one of the important and effective ways to deal with issues of polling, described as genetic because it depends mostly on simulating genetic work in living organisms to reach the optimal solution. It appeared in more than a mathematical representation, most famously are binary and continuous representations it called in some references a genetic programming, due to its high usability for programming and utilization of the concept of parallel processing to access solution [6].

Genetic Algorithm is one of the most important tools of the artificial intelligence because of the substantial deployment of its applications, especially in creative applications. It applications has proven its effectiveness in resolving many problems. Many Previous studies solved several problems like Peddler and referred to the matter for the first time in Germany in 1832 in the book "successful Peddler". Karl Manager is the first mathematical to write on this issue and that was later used to apply logical circles, industry and arrange them, routing delivery packet data across a network, and is also used in routing planes. As well as the problem of the backpack, which is designed to carry the most expensive, and the lightest in a backpack, and had

been addressed for more than a century. It is not known how the term arose issue backpack, though it was mentioned in the work of the mathematician scientist Tobias Danzig (1892-1956), who suggested that the name may have been originated in the popular heritage before it is mathematically issue modeling [1]. The Eight Queens Problem is that they rely on the random distribution of Queens, where there will not two Queens in the same row or column or diagonal [2].

Due to the success of the work of the Genetic Algorithm to find the best solutions to the aforementioned studies, it has been applied in order to find the best estimate of the cost of engineering projects, where data and information on the cost of such projects will be collected, and find the best estimate of the cost of the geometrical construction projects on higher profit as possible [3].

Genetic Algorithms are evolutionary technique using inspired techniques by natural evolution such as inheritance, mutation and selection and cross over to find optimal solutions of complex software problems, depending on the idea of "the survival is for the best". That is what led to their spread, particularly in applications that must have an optimal solution to the traditional solutions.

Investment costs for any draft proposal include a set of short-term financial capital usually called working capital. Despite the multiplicity of the concepts of working capital, the concept of the working capital within the project feasibility study includes a short term assets, which are estimated to meet the requirements of the first operational project life cycle.[4]

The main goal of engineering projects is providing service or social utility first without neglecting the profitability factor as a scale of the efficiency of the portability of the evolution.[5]

This paper discusses the problem of the initial estimate of the cost of engineering projects, where the preliminary estimate of the basic criteria in making decision for any project is General. Since the cost changes during implementation dramatically, because the factors affecting this difference are then is many, difficult to be tuned

(such as: the nature of the land, sudden changes in market prices, weather changes, etc.), the decision makers strive to develop tools that help them develop estimated as close as possible to reality during the subsequent implementation phases.

The problem is to determine the optimum solution which must be built of any engineering projects so as to exploit the maximum cost available.

This paper presents one of the tools of artificial intelligence, where its techniques are developed significantly and quickly. The Genetic Algorithm was used to take advantage to solve the problem of the initial estimate in civil engineering projects in order to get good accuracy compared with the reality in engineering projects.[6]

Genetic Algorithms are a way to mimic what nature does in the reproduction of organisms, and use that way to solve complex problems to reach the best solution, or the closest possible solution for a better solution. Then we have a problem with many solutions which most of them are wrong and some are true, there is always the best solution, which is often difficult to reach .

This paper, tries to build a small residential suburb with specific funding; so that the dwelling unit is composed of a certain number of residential buildings, a number of villas, and several commercial offices. The goal is finding the optimum number which must be built of each type, to exploit the maximum amount of funding available to achieve the biggest profit as possible.[7]

## II. Literature review

Janoud, A., Jafar, R. and Asfory, N. (2013) developed a model for Neural Network and Genetic Algorithms to help them predict the primary cost for the clinics. The result was that the good effect of the hybrid model among the Neural Network and Genetic Algorithms helped to solve the problems of the cost of the clinics. The mixing of the Neural Network and any other intelligent techniques such as Genetic Algorithms can improve the accuracy of the prediction of the cost; that helps to use the hybridism among the intelligent techniques to solve the problems of the predictions.[8]

Mahamid, I. and Bruland, A. (2010) described the development of linear regression models to predict the cost of road construction activities based on 100 sets of data collected in the West Bank – Palestinian National Authority.[9]

Fayek, A. and Flores, J. (2010) created the model of the fuzzy logic to define the relationships between the physical characteristics of a project and the expected quality using a cost ratio comparison between an ideal project (i.e., a cost model) and the project being compared. The fuzzy expert system provides the advantage of allowing assessments to be made in linguistic terms, which suits the way in which experts express themselves and captures

heuristic knowledge of the experts in assessing the quality of a project at the conceptual cost estimating stage.[10]

For the implementation processing, the VB.Net language was used to apply the practical side and to present the results.

## III. The proposed model

The proposed model depends on implementing an example for creating a small residential suburb; this model can be applied to several similar examples of this form.

In this proposal or study we have taken the support of the economic feasibility results which supposed to be identified in advance and before the building of the Genetic Algorithm.

The model examines the situation of launching a small residential suburb with funding maximum not exceeding 110000 monetary units. The units consist of a certain number of residential buildings and villas and commercial offices, with an estimated cost of establishing every type of those units and expected profit as in the table 1.

Type	The cost of construction.	The profit expected
Residential buildings	40000	30000
Villas	4000	2800
Commercial offices	1000	500

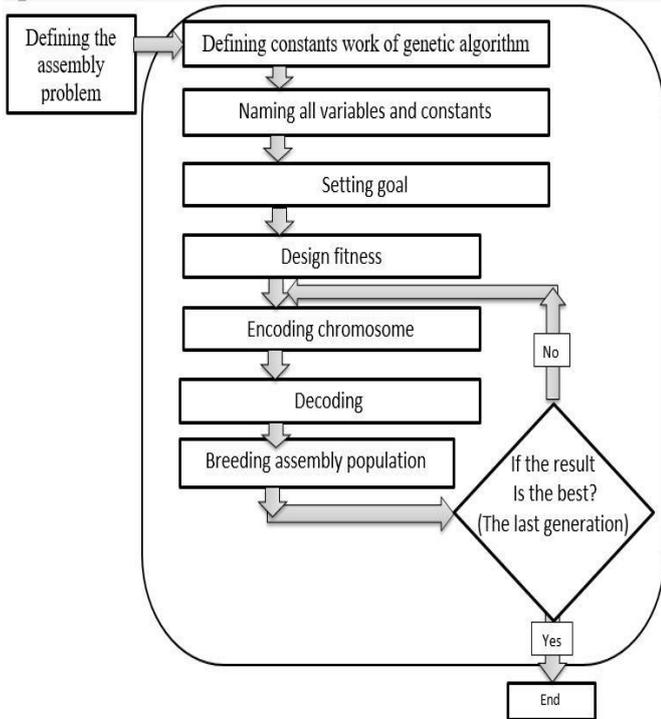
Table 1. data issue

Bearing in mind that these numbers are integers without fractions because it makes no sense to build two-and a half.

In this paper the Genetic Algorithm will used to determine the best distributed number which most build of each above mentioned units.

## IV. Implementing the Genetic Algorithm system

There are many language programming can be used to Implement the Genetic Algorithm system. We use the VB.Net to Implement our system. A figure 1 shows the proposed method using Genetic Algorithm.



**Figure 1. Block diagram of proposed method**

**A. Defining Genetic Algorithm action constants:**

The census and the number of generations are determined depending on the frequency of the algorithm and application used to obtain the best solution.

This form will identify the population and the number of generations. In this case, we assume the constant values for our Genetic Algorithm as shown in the table 2.

**Table 2. parameters issue**

Constant	The value
The population of chromosomes	Population =50
Number of generations	Generations =30
Proportion to the chromosome	Cross over Rate =60%
Mutation rate	Mutation=5%
The number of bits for each chromosome.	Bit Length =4

**B. Defining all variables and constants:**

The required variables and constants given in the form are defined as the maximum funding available for MAXC=110000 as in the table 3.

**Table 3. question variables**

	The profit expected	Construction cost per unit	Required number
Residential buildings	L1=30000	C1=40000	N1
Villas	L2=2800	C2=4000	N2
Commercial offices	L3=500	C3=1000	N3

**C. Target selection:**

The target is determined using the following equations:

• The profit value:  $Value = \sum_{i=1}^3 Ni * Li$  ——— (1)

• Total cost:  $Cost = [ \sum_{i=1}^3 Ni * Ci ] < = MAXC$  ——— (2)

The next goal is to find values of N1, N2, N3 which give the greatest possible value of financial profit Value provided that it does not exceed the total cost of the specified value MAXC= 110000.

**D. Designing fitness:**

According to these data, there are many evaluating functions that will do the trick, perhaps the simplest and not necessarily the best you can design the following function is used:

$Fitness = (Value) / (1 + (MAXC - Cost)^2)$  ——— (3)

Because of this, the fitness value reaches the highest value for the variable Value and total cost of maximum funding MAXC which required.

**E. Encoding of chromosomes:**

Assuming that the adoption of the necessary length of each chromosome is 4 bits, then the maximum number of villas or commercial offices or residential buildings is no. 1111 (15).

This figure is assumed to reduce survey area with appropriate coverage of possible solutions. If wanted to expand the maximum number of bits can be increased.

**F. Decoding:**

If the chromosomes are 101100101001, the result is:  
 N1=1011=11, N2=0010=2, N3=1001=9

By generating a population comprising 50 chromosome for this model, all the processes of Genetic Algorithms are done on them. The way that chromosomes are generated is the powerfully point of Genetic Algorithms, as they reach the survey coverage solutions (Global Solutions).

The chromosome's breeding process is done in three important stages:

- **Parent Selection:**

Breeding begins with choosing the parents, and the only measure in this choice is fitness. Although the chances of selecting a chromosome is associated closely with its fitness, the fittest chromosomes are the highest candidates in many times while the poor chromosome may not be selected at all.

- **Crossover chromosome:**

It represents the breeding process, after choosing the parents (who represent the two strings of binary numbers) the exchange point is very random. The first chromosome takes the last three bits of the second chromosome and gives it the last three bits of its string.

This process does not happen with all parents, but it is a specific percentage.

In this model, this process will be done on 60% of cases and does not apply to the rest.

- **Mutation:**

A new chromosome passes through sudden and random changes, so that one of its bits changes from zero to one, or vice versa. This process is important because it adds some new features that may not exist in the parents, in this model the change happens only by 5%.

The previous three stages are repeated 30 times so we get the fitness values as shown in the table 4.

**Table 4. generations algorithm**

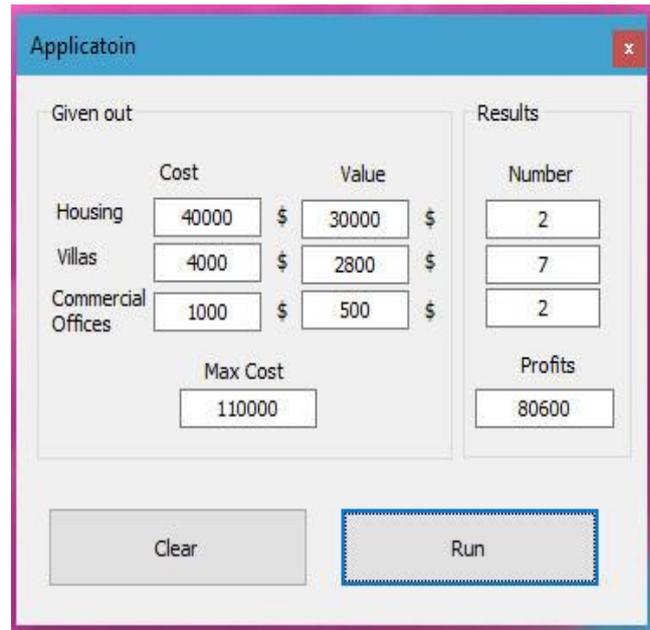
Generation	The first	The second	The third	...	From the fourth to the thirtieth
Fitness	0	0.2	0.2	...	80600

The Vb.Net language was used to apply the practical side and to present the results.

### V. Results

Apply the Genetic Algorithm using the equation (1 and 2). For a number of 30 specified generations.

The algorithm will reach the fitness for every generation. As a result, we got the best solution for the fourth generation, which percentage 86.66%, which is a perfect solution for this form, and the optimal number of variables is reached (N1=2, N2=7, N3=2). The results have emerged as in the figure 2.



**Figure 2. Results Obtained**

### VI. Discussion

Because of the ease and simplicity of the model 30 generations are made. The best solution was reached from the fourth generation. The function predicate is what needs careful consideration, because it is important in the installation of Genetic Algorithm that does not know a thing about the nature of matter, but only through the function predicate, and this function is reflected in all the exact nature of the issue and what they require.

The factors have a direct and significant effect on the results, but the change of these factors will give different results and we will get the results at a different generations. If the variables changed, you must make some changes to ensure the program is running correctly.

### VII. Conclusion

After completing this model, the following conclusions were reached:

1. To build elements of the algorithm, that include steps and mathematical disciplines for solving the issue is important, and affects the final solution, and those elements are selected by defining the issue to be resolved by using Genetic Algorithms is a good definition.
2. The last step in the algorithm is to write the code that implements the algorithm. Some programs provide facilities for such issues as programming languages that care about the mathematical side. However, the use of the well-known

programming language structure and the way it fixes programs makes this step easy and quick.

3. The more difficult and complex is the issue the greater sense of the importance and effectiveness of Genetic Algorithm. In addition, the program that was written to solve this model can be used to solve any other problem just by changing the predicate and bits. In condition that the number of variables 3 and not more than 15 numbers of element for each variable.

### VIII. The references

- [1]. David Williamson, David Shmoys (2011), (The Design of Approximation Algorithms 23/6/2016 10:30 pm.
- [2]. Vijay Vazirani (2001), (Approximation Algorithms. 30/6/2016 3:30 pm.
- [3]. arabteam2000-forum.com / index.php? /topic/168565-11:30 2016/7/3 pm. الخوارزميات-الجينية.
- [4]. عثمان سعيد عبد العزيز، "دراسات جدوى المشروعات بين النظرية والتطبيق"، كلية التجارة، جامعة الإسكندرية، طبع الدار الجامعية، سنة 2001، القاهرة.
- [5]. الدجيلي قاسم عبد الرضا، الفرجاني علي عبد العاطي، "التقييم الاقتصادي والاجتماعي للمشروعات"، دار النشر ELGA، سنة 2011، فاليتا مالطا.
- [6]. [http://www.futurescientists.sa/documents/10179/0/الخوارزميات الوراثي/3/7/2016 12:30 pm.](http://www.futurescientists.sa/documents/10179/0/الخوارزميات%20الوراثي/3/7/2016%2012:30%20pm)
- [7]. Matthew Wall - Overview of Genetic Algorithms, Mechanical Engineering Department Massachusetts, Institute of Technology (MIT).
- [8]. عصفوري نغم نعيم، جعفر راند، جنود علي، "تقدير التكلفة الأولية للمشاريع الهندسية باستخدام نموذج هجين بين الخوارزميات الجينية والشبكات العصبونية"، تاريخ الإيداع 2013/7/23. قُبل للنشر في 2013/9/17، مجلة جامعة تشرين للبحوث والدراسات العلمية، سلسلة العلوم الهندسية، المجلد (35) العدد (7) 2013.
- [9]. Ibrahim Mahamid and Amund Bruland, "Preliminary Cost Estimating models for Road Construction Activities", FS 4E - Critical Infrastructure Development, FIG Congress 2010, Facing the Challenges-Building the Capacity, Sydney, Australia, 11-16 April 2010.
- [10]. Aminah Robinson Fayek, Jose Ruben Rodriguez Flores, "Application of fuzzy logic to quality assessment of infrastructure projects at conceptual cost estimating stage", Canadian Journal of Civil Engineering, 2010, Vol. 37, No. 8 : pp. 1137-1147, (doi: 10.1139/L10-036).