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Full Length Article

Comparison of linear and non-linear programming methods and genetic algorithms in optimal allocation of water resources Minab dam

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ABSTRACT

One of the main factors of economic and social development of the country's potential reserves is blue. Recognizing the need for comprehensive water resources sustainable utilization of these resources is considered. This study aims to improve water resources management independence dam using model linear optimization and genetic algorithm is done. After running the model with the allocation of 100% need the water, Services and Technology, Answer on genetic algorithms and linear programming methods were compared in low-water scenario which was observed failure rate in getting Lingo software dehydration 31.34% compared to the allocation in the scenario without the program, are optimized. As well as by comparing the output of two software was detected the answer dehydration scenario objective genetic algorithms in order of the amount of error is 0.013. To collect the information needed study Hormozgan Regional Water Company survey data is used. Data analysis, linear programming software using Lingo Information and analysis was conducted genetic algorithm with Matlab.

Key words: optimize, water resources, genetic algorithm, linear programming

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INTRODUCTION

Recognizing the need for comprehensive water resources exploitation of these resources is sustainable. In Iran, due to the lack of rainfall in most basins and limited water resources, In order to understand the possibilities and limitations of systematic planning of water resources with the goal of optimal utilization is very essential and inevitable. Given the importance of water in human life and human water shortage to meet the needs of reservoirs behind dams as one of the most important sources of fresh water are important. That is why optimization is dams, including important issues in water resources management [7].

Nonlinear programming technique used to solve optimization problems is one of the ways that optimizes the objective function with the relevant provisions. The way to solve problems that constraint or objective function is used [1]. Lack of available water resources in the country as well as inappropriate distribution of water resources is obvious necessity this liner.

Appropriate rules for the operation of river dam's tanks as one of the most important components of water resource systems are necessary. After providing a practical problem associated with single-objective reservoir operation, linear programming model in the application environment offered which can be the most optimal allocation of water resources with the aim of maximizing profits determined .And using the results of the administrative measures necessary for optimal utilization of water resources in certain situations, dehydration, drought and ...... formulation was used. The application of such laws creates a balance between resources, optimize water use in agriculture, industry, drinking, and services and ultimately will achieve sustainable development of water resources management [2].

The methods used in this study
1- Genetic algorithm
Genetic algorithm is a method for solving optimization problems which was inspired by nature and processes based on biological evolution is performed. Theoretical evolutionary genetics method utilizes the principles of genetics as an effective way to optimization is the classic method that limits have been developed. This method is based on natural selection where possible the survival and reproduction of organisms with higher fitness become more after several generations to reach a higher degree of competence. The natural selection of the fittest evolution mathematically simulated. In the process of natural evolution of organisms have an initial comprehensive it randomly intersects with each other and couples with chromosomal composition of their reproduction. By repeating this process with regard to the principle of natural selection the next generation will be higher qualifications.
Genetic algorithms are decision variables such as genes the answer is a combination of some of them as string-like chromosomes is obtained. A number of options answer the question as members of society, are the marshes set of chromosomes them, new options are variable. By assigning the probability of survival to more favorable responses has been favored by natural selection and the new generation will be produced with higher fitness. By repeating this process after several generations, the most worthy is the generation that will produce the optimal response [6].
2- Linear programming
Linear Programming (LP) is a tool for solving optimization problems. In 1947, George Danzig an efficient method called simplex algorithm for solving linear programming (LP) developed. In general it can be said in a mathematical programming problem that the decision maker is willing to in order to maximize or minimize an objective function can be used linear programming that this issue is very important for managers [5].

MATERIALS AND METHODS
Study area
Instability conventional sources of water supply can be properly dealt with drought in a decade in Hormozgan clearly see, Because people in cities such as Bandar Abbas, Minab and Qeshm that supplies drinking water supply and agriculture dependent on Minab dam's independence, It is also important that the dam of its kind ever more shows. According to various crops, most notably watermelon, mango, banana and herbs are average consumption of 5.63 million cubic meters of Agriculture during the year in May, is intended for agricultural purposes. The amount due to evaporation amount will vary each month of the year. Agricultural required flow rate per month according to the average discharge rate of evaporation is calculated every month. Information on regional water discharge and evaporation area of the province is getting According to the monthly rate for a 15 year period from 1379 to 1394 has been collected.

Figure 1: Location studied geography in the province

Status of water requirement
Bandar Abbas is a barrier for independent water supply for domestic, industrial, services and agricultural lands of irrigation is constructed. Bandar Abbas and Qeshm addition to the current requirement of independence dam from other sources such as wells, dams and freshwater Shamil and Nian and.... well-

funded. According to the received information and statistics participation Hormozgan Regional Water show the drinking water needs of agriculture and industry statistical values are available in more than 94 years.

RESULTS

The purpose of this research is to find a model to allocate resources to the consumer is the water behind the dam independence. According to the model developed for drought conditions, but it can also be used in other modes. In order to create the conditions simulation system must be optimized. As shown in Figure 1 are shown Schematic reservoir and its input and output specified.

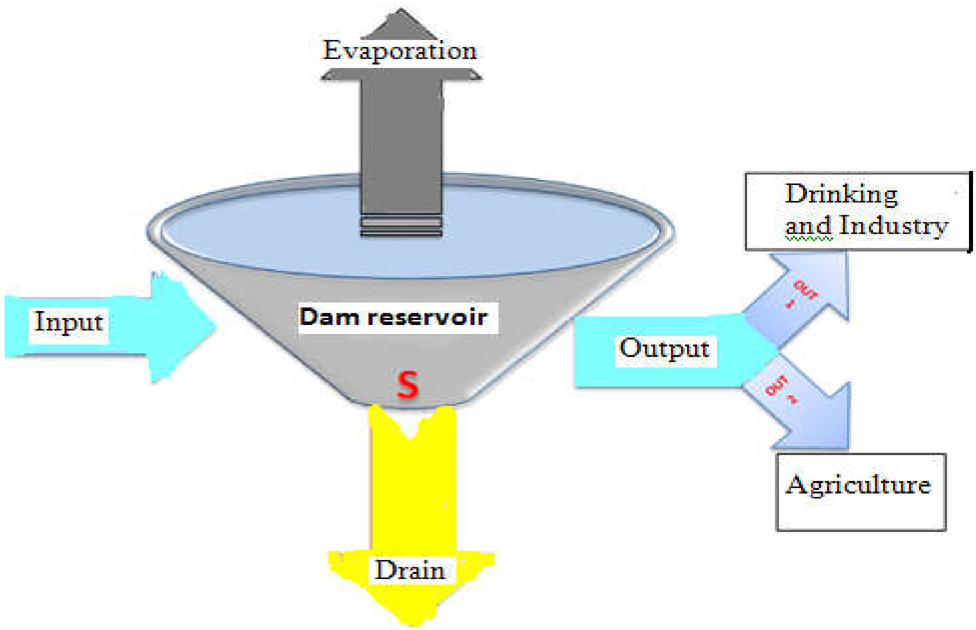

Figure 2: Schematic reservoir independence

As is known monthly a certain amount of input (in), the tank (S), and evaporation (E1), drainage (E2), as casualties tank (E) that can be removed from the tank And quantities of container needed to supply drinking and industrial output (OUT1), agriculture (OUT2), and overflow (OUT3) as output ((OUT, the dam is removed.

1- **Performing model in MATLAB (GA)**

As noted in this study by using a genetic algorithm optimization, the operation of the dam will be achieved. First genetic algorithm produces the answer. The answer includes a table cell is 12. Each cell represents the amount of discharge from the dam within a month of the year. According to the above equations and the condition of drinking water supply only the genetic algorithm to predict the value of agricultural output (out2) deals. The proposed amount specified by 12 of the other values such as the size of the previous period, the need for water, drainage and evaporation losses input value to determine the amount each pay period And if the amount of the allowed range (Kmin) is due to the failure of the answer to that rated And of course more likely to generation after generation of better solutions and will survive.

Table 3: Parameters used in the genetic algorithm

Value	Parameter	Number
1	Population Size	1000
2	Generations	1000
3	Migration Fraction	0.2
4	Elite Count	2
5	Crossover Fraction	0.8

According to what was said in the monthly input, evaporation and seepage losses, the need for drinking and agriculture in 15 years was used to estimate the drought period.

Table 4: output, storage tank failure scenario genetic algorithm dehydration of 90

The allocation of a genetic algorithm optimization tool			Statistical data dehydration scenario of 90				
Break	Reservoir storage	Output Agriculture	Dehydration scenario		Size Requirements		month
			Evaporation + leak Losses	Flow	Agriculture	Drinking	
f	**S**	**D**	**E=E1+E2**	**in**	**keshavarzi**	**shorb**	**month**
13.81	236.7	3.14	6.87	8.46	6.86	5.47	**1**
13.66	222.7	3.03	6.06	1.32	6.72	6.26	**2**
14.53	207.2	3.13	6.32	0.21	6.94	6.31	**3**
13.98	193.3	2.73	4.98	0.23	6.47	6.35	**4**
13.41	180.4	3.29	3.46	0.21	6.95	6.37	**5**
14.35	167.3	2.42	4.57	0.1	6.21	6.24	**6**
0	154.3	3.24	4.71	0.1	6.91	5.17	**7**
9.13	141.3	3.02	5.35	1.52	6.78	6.18	**8**
5.17	134.1	2.27	3.92	5.66	6.04	6.68	**9**
8.24	126.2	2.87	3.62	4.88	6.62	6.27	**10**
6.68	121.9	2.58	2.68	7.4	6.43	6.43	**11**
43.65	123.6	6.61	2.73	17.76	6.61	6.66	**12**
154.35		38.33	55.25	47.85	79.53	74.39	**total**
		243.76	Primary storage				
		121.88	Limit				

Table 5: non-optimal allocation and no plans to model scenarios in Blue 90

Non-optimal allocation of water scenario			Statistical data dehydration scenario of 90				
Break	Reservoir storage	Agriculture Output	Dehydration scenario		Size Requirements		month
			Evaporation + leak Losses	Flow	Agriculture	Drinking	
f	**S**	**D**	**E=E1+E2**	**in**	**keshavarzi**	**shorb**	**month**
0	233.02	6.86	6.87	8.46	6.86	5.47	**1**
0	215.29	6.72	6.06	1.32	6.72	6.26	**2**
0	195.93	6.94	6.32	0.21	6.94	6.31	**3**
0	178.36	6.47	4.98	0.23	6.47	6.35	**4**
0	161.8	6.95	3.46	0.21	6.95	6.37	**5**
0	144.88	6.21	4.57	0.1	6.21	6.24	**6**
13.54	131.89	3.23	4.71	0.1	6.91	5.17	**7**
45.93	121.88	0	5.35	1.52	6.78	6.18	**8**
36.48	116.94	0	3.92	5.66	6.04	6.68	**9**
43.8	111.93	0	3.62	4.88	6.62	6.27	**10**
41.4	110.22	0	2.68	7.4	6.43	6.43	**11**
43.63	118.59	0	2.73	17.76	6.61	6.66	**12**
224.77		43.37	55.25	47.85	79.53	74.39	**جمع**
243.76	Primary storage						
121.88	Limit						

- Lingo software implementation models (linear programming)

Dehydration scenario of 90 Information on water scenarios as input to the model optimizer software enters Lingo, In data entry, Lingo can input data in the context of the program calls And the answer in the output display As well as the software have the ability to recall data from Excel. And can also answer directly to the database and software modeling spreadsheet such as Excel import.

Table 6: output, storage tank with Lingo software failure scenario dehydration in 90 years

Allocation Optimizer software Lingo				Statistical data dehydration scenario of 90				
Overflow	Break	Reservoir storage	Agriculture Output	Dehydration scenario: Evaporation + leak Losses	Dehydration scenario: Flow	Size Requirements: Evaporation + leak Losses	Size Requirements: Flow	month
sarriz	**f**	**S**	**D**	**E=E1+E2**	**in**	**keshavarzi**	**shorb**	**month**
0	14.03	236.76	3.11	6.87	8.46	6.86	5.47	**1**
0	14.03	222.78	2.98	6.06	1.32	6.72	6.26	**2**
0	14.03	207.17	3.19	6.32	0.21	6.94	6.31	**3**
0	14.03	193.35	2.72	4.98	0.23	6.47	6.35	**4**
0	14.03	180.53	3.2	3.46	0.21	6.95	6.37	**5**
0	14.03	167.36	2.46	4.57	0.1	6.21	6.24	**6**
0	14.03	154.43	3.16	4.71	0.1	6.91	5.17	**7**
0	14.03	141.39	3.03	5.35	1.52	6.78	6.18	**8**
0	14.03	134.16	2.29	3.92	5.66	6.04	6.68	**9**
0	14.03	126.27	2.87	3.62	4.88	6.62	6.27	**10**
0	14.03	121.88	2.69	2.68	7.4	6.43	6.43	**11**
0	0	123.64	6.6	2.73	17.76	6.61	6.66	**12**
0	154.32		38.33	55.25	47.85	79.53	74.39	**جمع**
		243.755	Primary storage					
		121.8775	Limit					

CONCLUSION

This article aims to provide independence dam water allocation program to Bandar Abbas and drinking industry is agriculture. Statistics and water requirement zone were studied. And then applies to the input of the dam was defined scenarios And by the region's water needs vaporization two-Saver and Saver genetic algorithm and Lingo came in. The two models assuming full allocation of water began to create table shows the monthly discharge, in a scenario of a farm by minimizing assignment failure rate of 154.35 reached after running the model in MATLAB and Lingo, compared responses were observed the answers are almost equal in both optimizer software.

Table 7: Comparison of model failure in a genetic algorithm, Lingo and non-optimal allocation

Genetic algorithm error	Optimized (Percent)	non-linear failure	Optimized (percent)	Failure to genetics	Optimized defeat	scenario
0.013	31.34	154.32	31.33	154.35	224.77	Dehydration

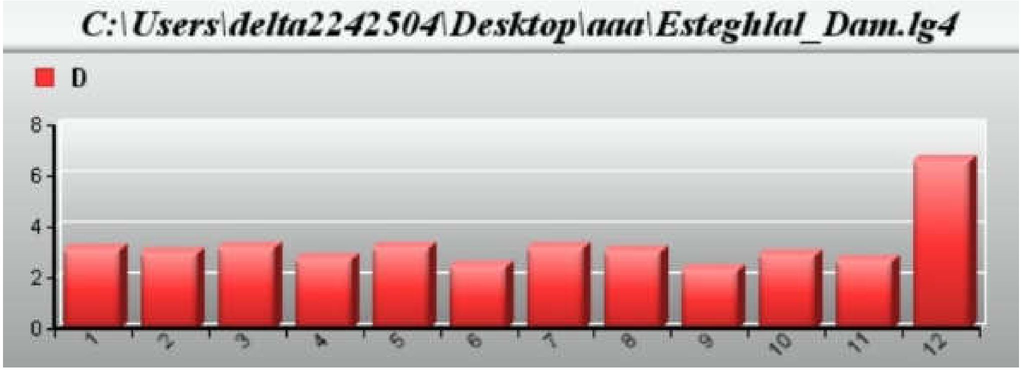

Figure 3: Output and call graph model in the Lingo software dehydration scenario of 90

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