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$$\text{Max or Min } f(x) = \sum_{i=1}^n c_i x_i = \underline{c}^T \underline{x}$$

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$\underline{c}^T$

$\underline{x}$

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$f(\underline{x})$

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$$a_{11}x_1 + a_{12}x_2 + \dots + a_{1n}x_n \leq b_1$$

$$a_{r1}x_1 + a_{r2}x_2 + \dots + a_{rn}x_n \leq b_r$$

$$a_{m1}x_1 + a_{m2}x_2 + \dots + a_{mn}x_n \leq b_m$$

$$x_1, x_2, \dots, x_n \geq 0$$

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$$\text{Max} z = 134.392x_1 + 19.5538x_2 + 3.25x_3 + 0.2x_4$$

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Subject:

$$1) x_1 + x_2 + x_3 + x_4 + s_1 = 19535$$

$$2) 925x_1 + 802x_2 + 495x_3 + 1000x_4 + s_2 = 15000000$$

$$3) 3.14x_1 + 3.75x_2 + .74x_3 + .02x_4 + s_3 = 21793$$

$$4) .16x_1 + .2x_2 + x_3 + .1x_4 - s_1 = 2500$$

$$5) 340.728x_1 + 10x_2 + 20x_3 + .2x_4 + s_4 = 90000$$

$$6) 134.392x_1 + 19.5538x_2 + 32.5x_3 + .200x_4 - s_2 = 108000$$

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$$7) 3.6x_1 + s_5 = 8000$$

$$8) 1x_2 + s_6 = 5000$$

$$9) 20x_3 + s_7 = 10000$$

$$10) x_1, x_2, x_3, x_4, s_1, s_2, s_3, s_4, s_5, s_6, s_7, s_8, s_9, s_{10}, s_{11}, s_{12}, s_{13}, s_{14}, s_{15}, s_{16}, s_{17}, s_{18}, s_{19}, s_{20} \geq 0$$

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## Watershed system planning and management using optimization model (Case study: Gharmabdasht Watershed)

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(Received: 28 August 2007, Accepted: 11 March 2009)

### Abstract

The system analysis plays an important role in natural resources, water resources and industrial engineering. In recent years, most parts of Iran like Golestan province, due to the lack of integrated river basin management, have been suffered numerous losses in variant environmental, social and economic aspects. In this paper an application of system analysis has been applied to optimal pattern of various resources in Gharmabdasht Watershed situated in Golesten province, Iran. To achieve an optimal allocation of natural resources in this area, firstly a linear programming algorithm has been used to maximize the benefits. Then its results have been compared with an optimal allocation of resources using a goal programming. This comparison shows if a single objective optimization (LP) be formulated correctly, it can be that the proposed pattern, has been acceptable outputs in which be compared to goal programming(GP). The allocation natural resources based on LP method, in addition to reducing %10 of sediment from admissible amount effected by safety flood abatement criterion, has also maximized the beneficiary incoming with %5 plus needful along satisfied all of the goals.

**Keywords:** System analysis, Flood abatement, Optimal allocation, Integrated management, Gharmabdasht Watershed