Abstract – Sometimes, some companies with consideration to their production capacity cannot respond to their demand. If demand increases and company doesn’t have sufficient capacity to respond to such demand, it will encounter backlogging. Also, in a multi-item company, if the number of products increases, the company may not be able to produce some products, thus backlogging will be occurred. In this paper, we consider such companies that will encounter the mentioned conditions and will be enforced to buy some products from outside. The aim of this paper is determination of optimum quantities of make and buy for each product to minimize total inventory cost. We refer to the proposed model as make-with-buy model. In this paper we formulate the make-with-buy model and solve it by genetic algorithm through Matlab software.

Keywords - Inventory cost, Make-with-buy, Multi-item, Optimization

I. INTRODUCTION

The make-or-buy issue was first brought up by Ford and Porter [1] in 1915. They stated in their article that in view of changing conditions, to make or buy is a question which must constantly be answered by manufacturers. Reasons for buying and making have been presented by Higgins [2]. And due to its multi-disciplinary nature, the make-or-buy has since been an important issue to most of the manufacturing firms. A considerable amount of research has been carried out to address the make-or-buy decisions. From the literature review two main streams were identified, as indicated by Canez et al. [3]. The first stream aims at answering the make-or-buy question from a cost viewpoint. Examples among them are Raunick and Fisher [4], Bassett [5], Ellis [6], and Balakrishnan [7]. The second stream approaches make-or-buy from a strategic perspective, considering other factors in addition to the cost. Examples among them are Ford and Porter [1], Higgins [2], Moreley [8], and Ford and Farmer [9]. Additional examples are surveyed in [10-16].

Cost is identified as one of the main streams from the aforementioned literature review, and it is always considered as an importance factor in the other stream where the multi-attribute analysis is used for the strategic make-or-buy decision making. For example, the results of a selective survey of 23 companies from Higgins [2] indicated that cost was the biggest determinant in the decision to make or buy.

Literature review indicates that recent researchers have dealt with make or buy model. In this paper, we present and expand make-with-buy model. This model will be applied when production rate is more than demand rate in the conditions that there are several products and restriction in production capacity. Also, one of the most important applications of this model can be in outsourcing strategy.

This paper is organized as follows:

After this introduction, we deal with the significance of the proposed model. Section 3 indicates problem assumptions. Section 4 is devoted to problem modeling. Section 5 gives a numerical example. Finally, section 6 presents the conclusions of this paper.

II. MOTIVATION AND SIGNIFICANT OF MODEL

In this paper, we deal with make-with-buy model. This model is applicable when production rate is more than demand rate, and when we encounter multi-item condition along with production capacity restriction. Assume that we produce several products by single machine, and this machine can produce all products without backlogging. When demand or the number of products increases, the machine may not be able to produce all products, so we will encounter backlogging and its huge costs. In such condition, we need to buy some products and hold them; by using this method we prepare more time (opportunity) for the machine to produce all products and to prevent backlogging. We refer to this issue as make-with-buy model.

In this paper, we formulate make-with-buy model to minimize total inventory cost such as holding cost, ordering cost, and purchasing and production costs. After solving this model we determine optimum quantities of make and buy for each product.

III. ASSUMPTIONS

1- Demand rate is certain and deterministic.
2- Production rate is certain and deterministic.
3- Shortage isn’t allowable.
4- All items are produced by single machine.
5- The machine can produce one item at a time.
6- For each item, production rate is more than demand rate.