



## Simulation Tool for Assignment Models: SIMASI

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### ABSTRACT

In this paper, an integrated simulation optimization model for the assignment problems is developed. An effective algorithm is developed to evaluate and analyze the back-end stored simulation results. This paper proposes simulation tool SIMASI (Simulation of assignment models) to simulate assignment models. SIMASI is a tool which simulates and computes the results of different assignment models. This tool is programmed in DOT.NET and is based on analytical approach to guide optimization strategy. Objective of this paper is to provide a user friendly simulation tool which gives optimized assignment model results. Simulation is carried out by providing the required values of matrix for resource and destination requirements and result is stored in the database for further comparison and study. Result is obtained in terms of the performance measurements of classical models of assignment system. This simulation tool is interfaced with an optimization procedure based on classical models of assignment system. The simulation results are obtained and analyzed rigorously with the help of numerical examples.

### Keywords

Simulation; Dot.net; Assignment models; Performance Measures.

### Academic Discipline And Sub-Disciplines

Mathematical modeling, Simulation.

### SUBJECT CLASSIFICATION

Mathematics.

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## INTRODUCTION

Assignment models are very important and fundamental problems of the optimization research area. Assignments models are applicable in signal processing, vehicle routing, virtual output queuing and multiple object tracking problems. A number of assignment models have been developed by using Hungarian algorithm, heuristic and genetic algorithm for diversified applications.

Generalized flexible demand assignment model is defined for unnamed aerial vehicle [1]. This model accepts orders from a large set of available orders and considers setup time between operations of two consecutive of tasks. An interesting application of generalized FDA is unmanned aerial vehicle (UAV) assignment problem. This formulation considerably reduces the size of the problem compared to some recent results. An efficient heuristic algorithm for 2D  $h$ -hops range assignment problem was developed [2]. Given a set  $S$  of  $n$  radio-stations on a 2D plane and an integer  $h$ , the range assignment problem is to assign ranges to the members in  $S$  such that each member of  $S$  can communicate with all other members in  $S$  using at most  $h$  hops, and the sum of powers required for all the members in  $S$  is minimized. The general 2D  $h$ -hop range assignment problem is known to be NP-hard [3]. Some simplified variations of the problem and efficient polynomial time algorithm for obtaining optimal solution is proposed.

A mathematical model of the assignment problem with restriction of qualification is set, a method of judgment the existence of a solution for this problem is given by transforming the cost matrix into the decision matrix; furthermore, the cost matrix is transformed into solution matrix when the problem has a solution and then the assignment problem with restriction of qualification is transformed into the traditional assignment problem [4]. Hungarian algorithm, is not directly applicable to manufacturing scheduling problems, because solutions of resource allocation problems may violate precedence constraints among processes that constitute individual manufacturing jobs. To apply Hungarian algorithm to scheduling problems, several strategies for assigning prices to time slots of individual machines, which are allocated to processes, are proposed [5]. Modeling of complex physical systems with Modelica usually leads to the high-index differential algebraic equation system (DAE), index reduction is an important part of solving the high-index DAE. The structure index reduction algorithm is one of the popular methods, but in special cases, it fails. Combinatorial relaxation algorithm can detect and correct the breakdown situation. Three implementations of the Hungarian algorithm are presented and shows that the BFS single-augmented method is better than others [6]. A Hungarian method based algorithm is developed to reconfigure a defect-tolerant manycore platform and form a unified application specific virtual core topology of which the timing variations caused by such reconfiguration are minimized. The proposed metric is able to accurately measure the timing differences between different NoC topologies. The standard deviation between the calculated difference using the metric and the difference obtained through simulation is less than 6.58%. The developed Hungarian method based algorithm using the metric performs close to the optimal solution in comparison to random defect-redundant core assignments [7]. An efficient method of fitness definition for automated design method of dynamic systems based on bond graphs and genetic programming is proposed. The automated design method based on Hungarian algorithm and genetic programming (HAGP) is proposed, and the statistic results of domain independent – an eigenvalues –placement design problem, which is tested for some sample target sets of eigenvalues, strongly shows the search capability of HAGP is good enough to make feasible automated design and obtain high-quality, well evolutionary solutions with less computational efforts, rapid speed in convergence compared to other state-of art algorithms [8]. This research integrates the Hungarian Method and Genetic Algorithm to find the shortest distance route and the distance or the approximately shortest distance route and the distance, and constructs the shortest distance route system for traveling. The system needs only a personal computer to find the shortest distance route and its corresponding distance quickly and effectively [9]. A simulation model is developed for queuing models, discussing the deterministic queuing models [10]. Verification and validation techniques are discussed for simulation models [11].

This paper proposes a simulation tool to calculate optimum results of assignment problem by Hungarian Methods. At the first stage of research, only simple examples are taken in to consideration. In the next phase of research, complex models will be taken. This tool SIMASI is developed as user friendly tool and it only need to specify the matrix values for source availability, destination requirement and associated cost of each cell.

## MATERIAL AND METHODS

It's an event driven tool developed in VB.Net, following specifications for the tool are as follows. It uses Microsoft Visual Studio 2008 (FrameWork 3.5) for front end. For fast development of project application interface and business logics, easy to deployment and maintain. It works on Microsoft windows(7,XP) as platform. It need Installed & Functioning network with Pentium iv processors or higher. Hard disk space should be 1GB or higher and 2 GB Memory space(RAM) or higher. The flowchart for simulation tool SIMASI is shown in fig. 1.

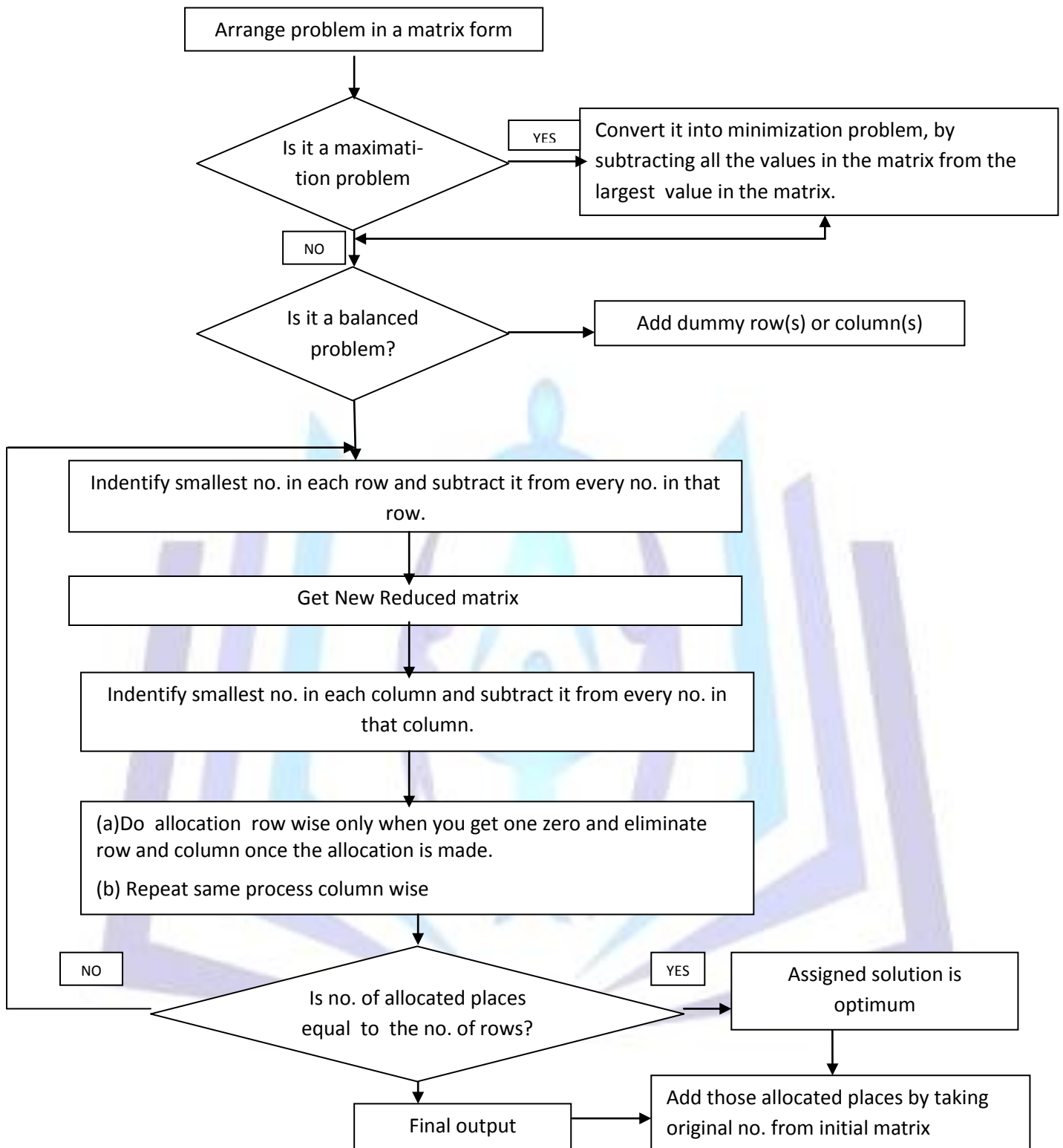


Fig.1

## ALGORITHM FOR SIMASI

1. Take two  $3 \times 3$  matrix(i , j) in which second matrix is a copy of first matrix ,make changes in the second matrix and compare with first matrix for final solution.
2. Now take the values from matrix kept in the Form of textbox in the following manner Eg.(Do it for all 9 text boxes).
3. Now apply the row minimum to the matrix and replace the second matrix with the new matrix (subtracting minimum value from each row).
4. Now apply the column minimum to the matrix and replace the second matrix with the new matrix (subtracting minimum value from each column).
5. Now we get the resultant matrix and we will allocate the zero's in the resultant matrix
6. Finally we will add all the allocated zeros to find the optimum solution.

## DISCUSSION

The user interface for SIMASI tool is shown in fig. 2. Panel for input in the matrix is on the left top with blue colour. Input values for the matrix will be shown in another panel in purple colour.

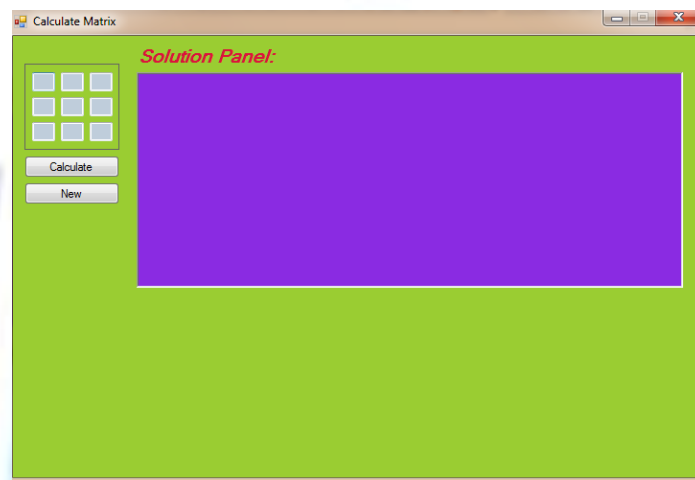


Fig. 2

After entering the matrix at the top left matrix input panel, CALCULATE button will be pressed and the optimum solution for the input matrix will be calculated.

Process for calculation will be as follows.

- a) Firstly row minimum will be applied to the matrix. Then minimum row value will be subtracted from the other values of row and this will be applied to all the rows of matrix.
- b) Now a new matrix will be obtained after applying the row minimum operation and same will be applied to the column. A resultant matrix in which allocations will be done.

As we have taken  $3 \times 3$  matrix so in case we don't enter the third row the tool will take a dummy row and made the calculations.

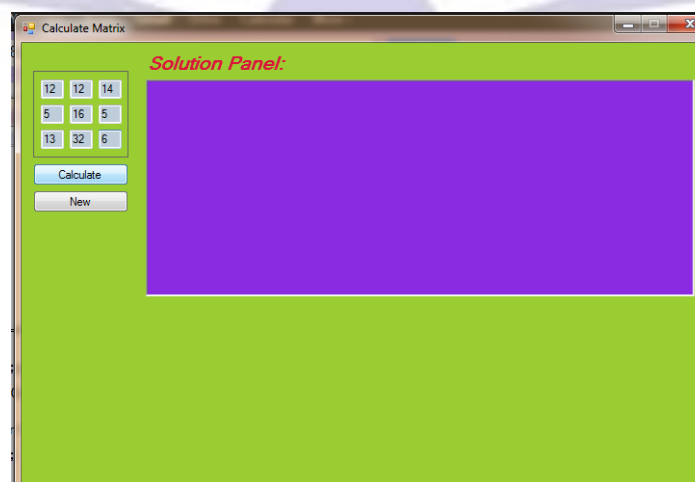


Fig. 3

After pressing calculate, calculations are shown in fig 4 and the result has been displayed in the third panel with green colour.

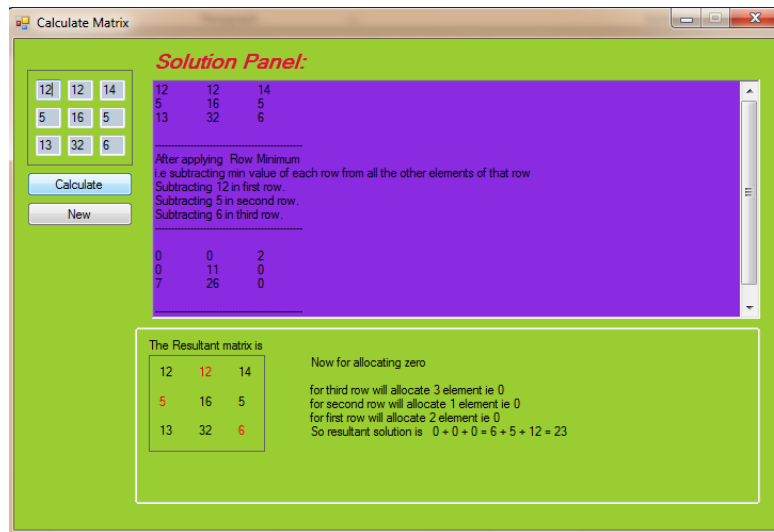


Fig. 4

## CONCLUSION

The Multi-objective SIMASI simulation Model of the Assignment model is presented in this paper. SIMASI can calculate the total cost of the assignment problem by optimizing the allocations. The numerical experiments shows that the queuing system with SIMASI is much efficient than the queuing system without it. This simulation tool can be applied to various assignment systems to optimize the results and to evaluate the optimum number of allocations in a system. The further work can be focused on the queuing system with complex assignment management information system.

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