Dynamic Resectorization to Improve Utility of Healthcare Systems, Implementation

Aydin Teymourifar, Maria A. M. Trindade

1. Implementation

The model is implemented in the Rockwell Arena 14 software. We utilize a system with an Intel Core i5 processor, 2.4 GHz, with 12 GB of RAM. Figure 1 presents an overview of the model's structure as implemented in Arena Software.
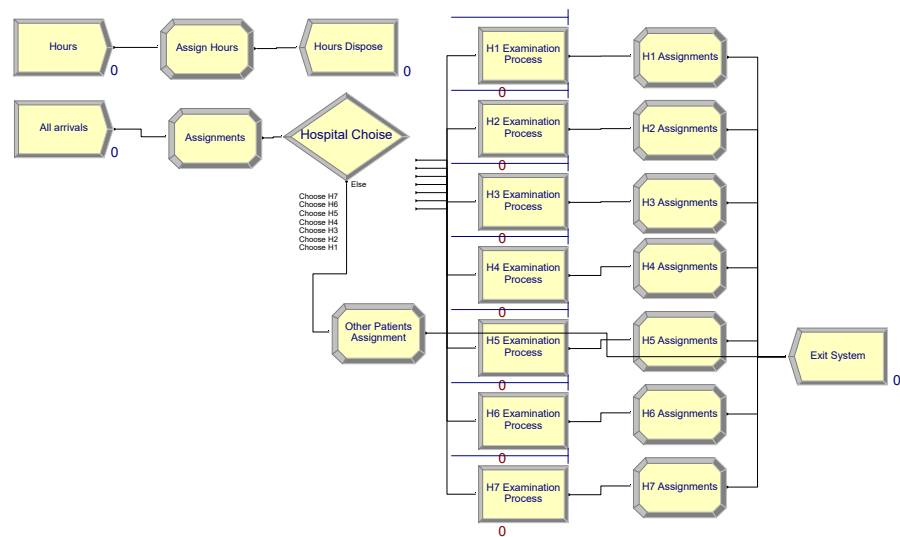

Figure 1: Overview of the Model in Arena Software.

As seen in Figure 2, the patients' inter-arrival times are generated the Exponential distribution in the Create module in Arena.

Figure 2: Patients' inter-arrival times modeled with Exponential distribution in Arena's Create module.

As seen Figure 3, the parameter of Exponential distribution, decision variable, quality levels, and costs are identified as variables.

	Name	Rows	Columns	Data Type	Clear Option	File Name	Initial Values	Report Statistics
1	Arrival Rates	24		Real	System		17 rows	☐
2	Unit Quality Level in H1			Real	System		1 rows	☐
3 ▶	Fixed Cost H1	▼		Real	System		1 rows	☐

Variable - Basic Process

Figure 3: Exponential distribution parameters, quality levels, and costs, defined as variables in the Arena software.

As seen in Figure 4, the quality and waiting time sensitivities and distances from hospitals are assigned to each patient as attributes.

Attribute - Basic Process

	Name	Rows	Columns	Data Type	Initial Values
1	H1 Distance			Real	0 rows
2	Snqu			Real	0 rows
3	Snwt			Real	0 rows

Figure 4: Quality and waiting time sensitivities and distances from hospitals as the attributes of patients.

As shown in Figure 5, capacities, i.e., the number of teams that do examinations in hospitals, are defined in the Set module.

Set - Basic Process

	Name	Type	Members
1	H1 Examination Team	Resource	4 rows
2	H2 Examination Team	Resource	4 rows
3	H3 Examination Team	Resource	4 rows
4	H4 Examination Team	Resource	2 rows
5	H5 Examination Team	Resource	2 rows
6 ▶	H6 Examination Team	Resource	2 rows

Figure 5: Definition of hospitals' capacity in the Set module.

As seen in Figure 6, inequality and its related components are defined in the Expression module of the Arena software.

	Name	Rows	Columns	Data Type	File Name	Expression Values
1	H1 Utility			Native		1 rows
2	Choose H1			Native		1 rows
3	H2 Utility			Native		1 rows
4	Choose H2			Native		1 rows

Figure 6: Definition of inequality 2 and Its components in the Expression module of the Arena software.

If patient i chooses H_j in period t, then $x_{ij}^t = 1$. As shown in Figure 7, this decision is made in the Decide module of the Arena software.

Figure 7: Patients' hospital selection decision in the Decision module of the Arena software.

The patients who choose one of the hospitals in the region exit the system after going through a Process module of the Arena software representing the examination process, which is shown as in Figure 8.

Figure 8: The examination process in the Arena software for patients choosing H_1.