AIRPORT SIMULATION

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What is Simulation?

Simulation refers to a broad collection of methods and applications to mimic the behavior of real systems, usually on computer with appropriate software. In fact, “simulation” can be an extremely general term since the idea applies across many fields, industries and applications. These days, simulation is more popular and popular than ever since computer and software are better than ever.

Why Airport Simulation?

Major airport development projects need to be evaluated in terms of their ability to deliver increased capacity, improved performance and a better experience for travellers. Assessment of solutions is difficult in real life, since it corresponds to changing operational procedures and future traffic characteristics. It is therefore important to have sophisticated simulation tools in place to aid decision support.

Also, it has been observed that people have to wait in long queues for immigration process and at the luggage counter. So through these simulation models, different situations are going to be analyzed so that waiting time of the passengers during various processes at airport is reduced.

If airport investments over the next years are planned, only simulation software and models can help to ensure that this money is wisely invested with an appropriate payback in terms of ROI.

With Airport Simulation we have an opportunity to procure a system solution to improve and develop airport and especially terminal planning and gain from the benefits of improved decision-making and knowledge-sharing that is the key to successfully managing terminal capacity.

Simulation Modeling

Modeling , is a method of solving problems, in which the system under study is replaced by a simple object that describes the real system and/or its behavior and is called a model.

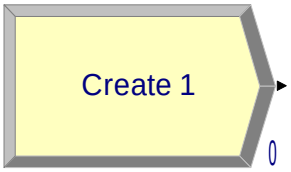
Simulation is used when conducting experiments on a real system would be impossible or impractical: for example, because of the high cost of prototyping and testing, or because the fragility of the system will not support extensive tests, or because of the duration of the experiment in real time is impractical.

Experiments via simulation model have several important advantages versus physical experiments:

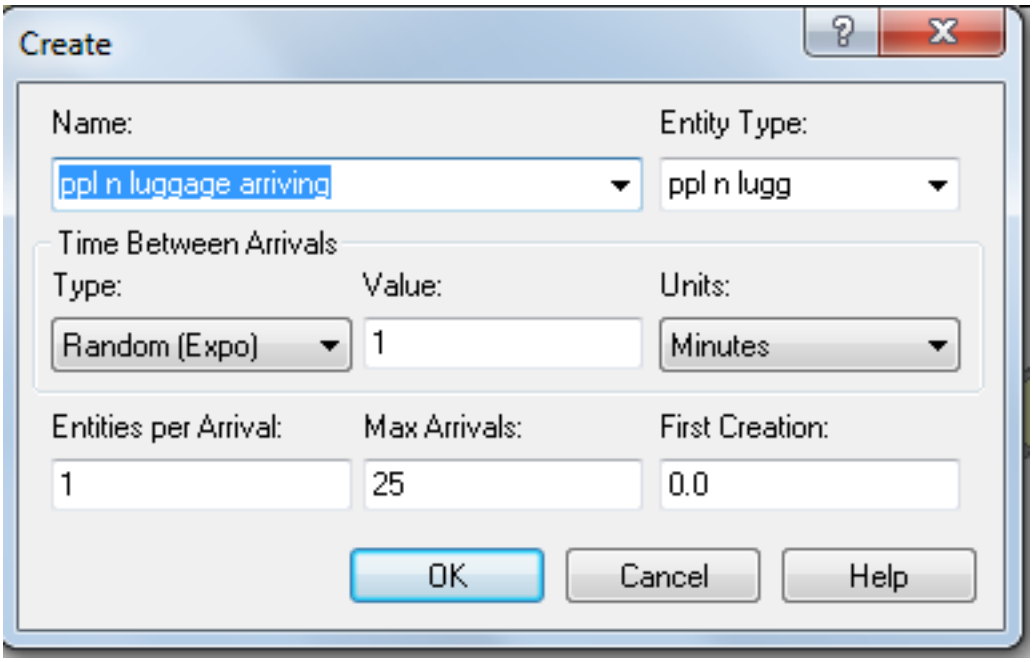
- **Value.** A simulation model can offer a dramatic return on investment. Suppose a company has revenue shortfall and they respond by cutting staff. But this also lowers customer service and response time, causing reduced sales and further revenue attrition. A simulation could be used to balance key parameters such as discounts, process changes, advertising, and many other factors needed to balance this redefined system.
- **Time.** In the real world evaluating the long-term impact of process or design changes can take months or years. A simulation model will inform your thinking in only minutes.
- **Repeatability.** Modern life requires organizations to quickly respond to changing market conditions. Analyses such as product demand forecasts have to be prepared quickly yet their results can be critical. A marketing team could use of a simulation model and vary parameters such as price and market segment for an unlimited number of experiments.
- **Accuracy.** Traditional computational mathematical methods require a high degree of abstraction and do not account for important details. Simulation modeling allows us to describe the structure of the system and its processes in a natural way, without resorting to the use of formulas and strict mathematical relationships.
- **Visibility.** A simulation model enables the visualization of the system over time; animations illustrate the system in operation and graphical outputs quantify the results. This allows us to visualize the resulting decision and dramatically simplifies the task of bringing these ideas to client and colleagues.
- **Versatility.** Simulation allows us to solve problems in any area: manufacturing, health and logistics, and many others. In each case, the model simulates real life and allows for a wide range of experiments with no impact on real objects.

DESCRIPTION OF THE METHOD USED

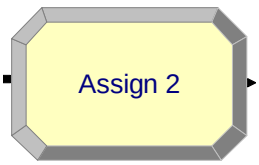
To make the model for Airport Simulation, Rockwell Arena Simulation Software has been used in this project, the details of which have been mentioned in this report.

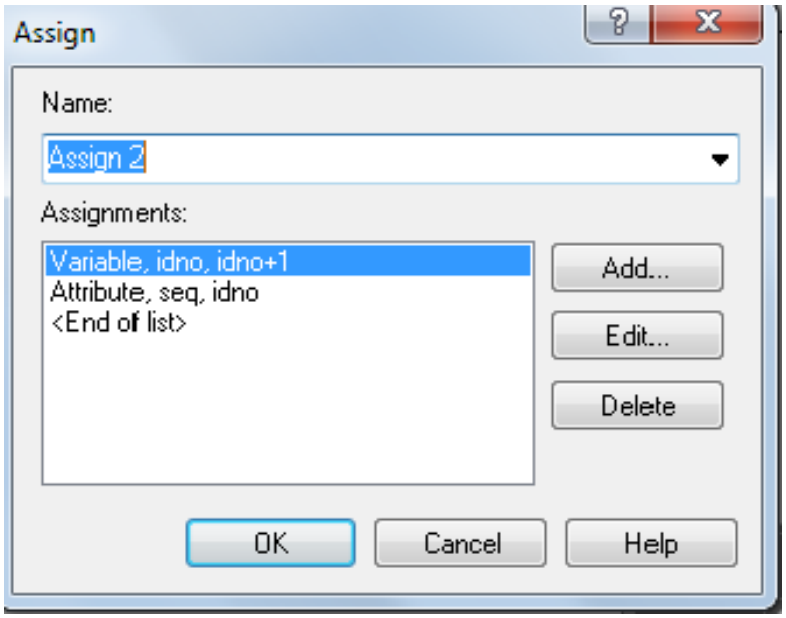


- The create module is used to create the number of entities entering the system. Here 25 entities are created named ‘ppl and luggage’. The number of entities can be changed according to the situation. These entities arrive randomly in the module.

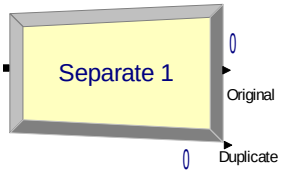


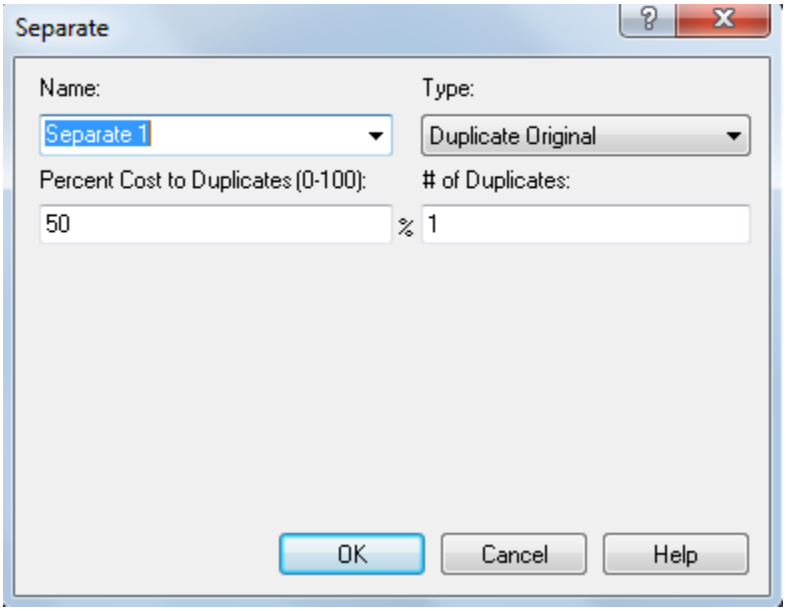
- As soon as people enter the module with their luggage, they are given an attribute 'seq' which is assigned the value of 'idno'. They are assigned a variable 'idno' which gets incremented after each entity passes through the assign module. These assignments ensure that each person that enters the module is given a unique identification number which is used later in the model.



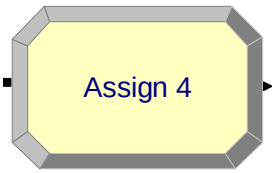


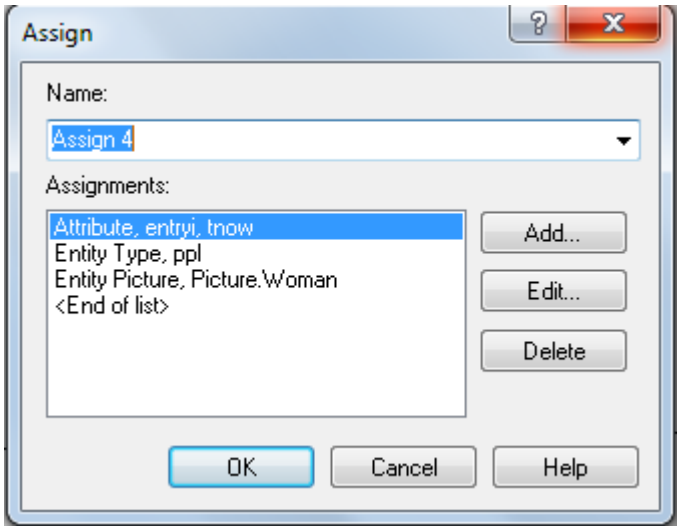
- The separate module is then used to separate people with their luggage so that people enter the immigration counter and the luggage enters the luggage counter.



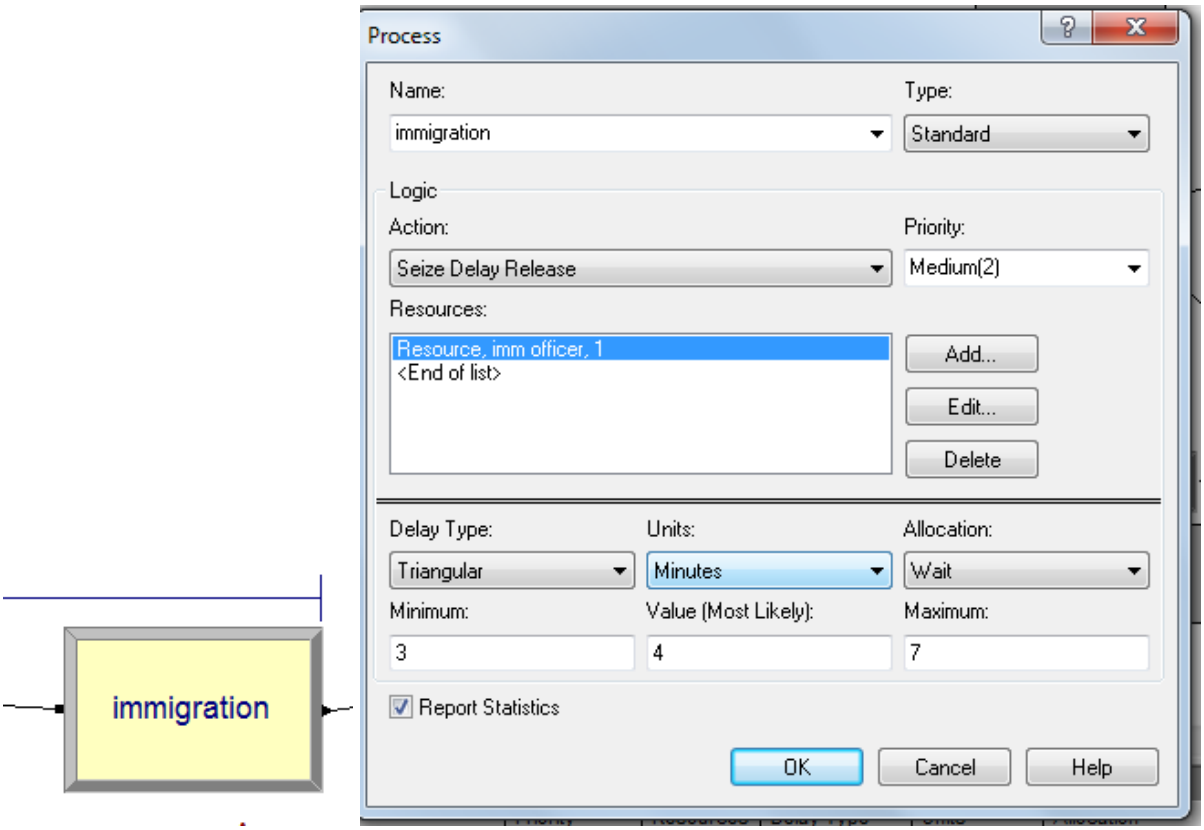


- As the entity 'people' are about to enter the immigration process module, they are assigned an attribute entry time named 'entryi', which is given the initial value as 'tnow' (present time) and also assigned an entity picture. These assignments are done using the Assign module.

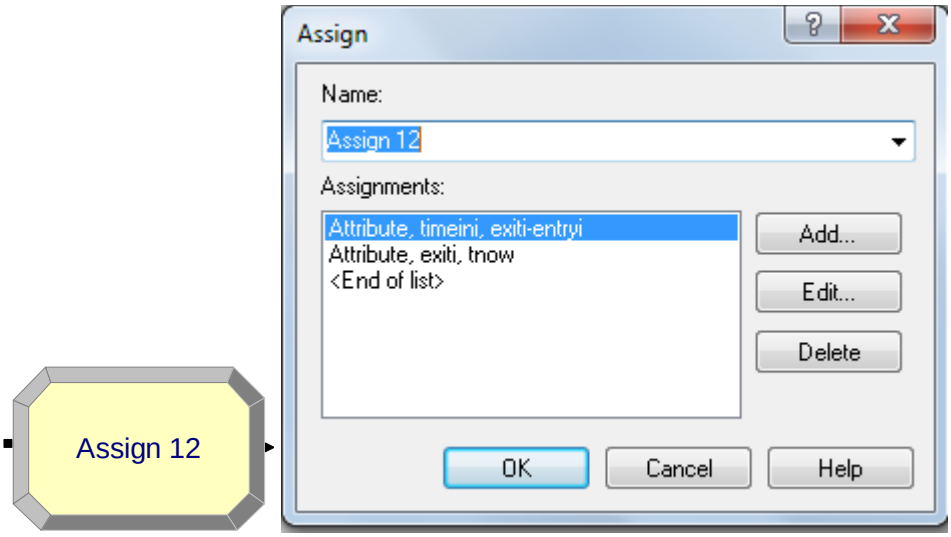




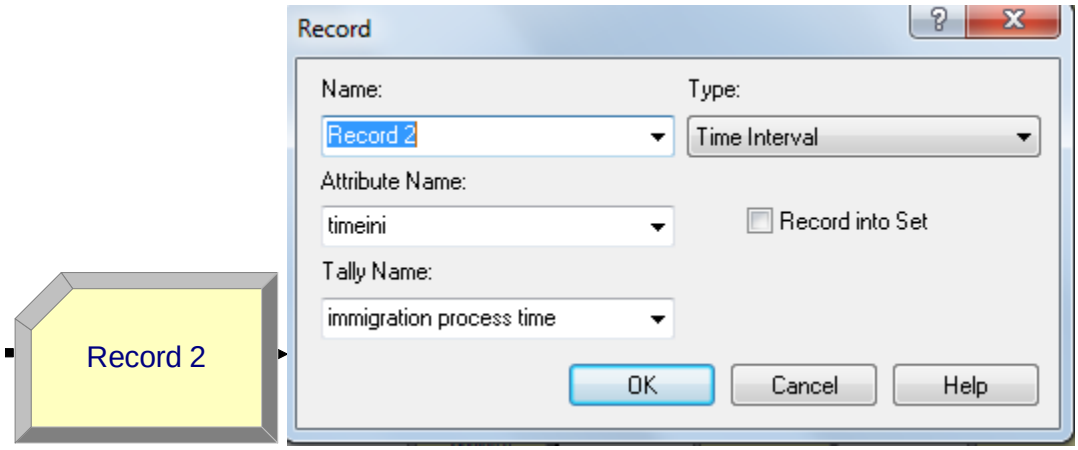
- The immigration Process is provided with the resource immigration officer. The delay time in immigration process is of triangular type with minimum and maximum value being 3 and 7 minutes.



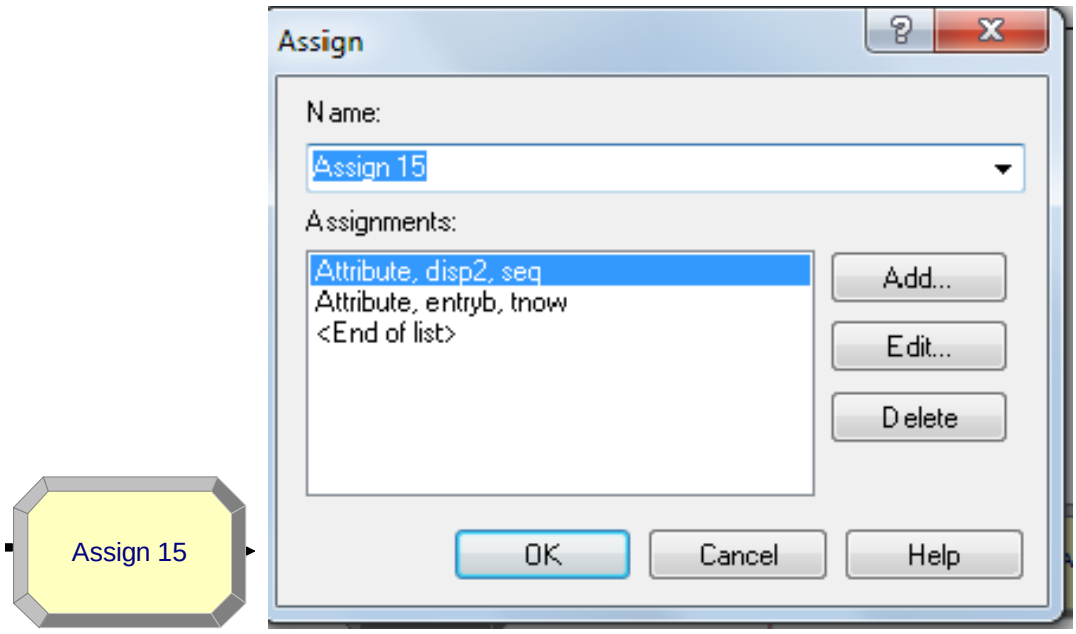
- As the entity comes out of the immigration process, the exit time is noted and the time taken in the immigration process is calculated as 'timeini'=exit time-entry time for each entity. These assignments are also made using the assign module.



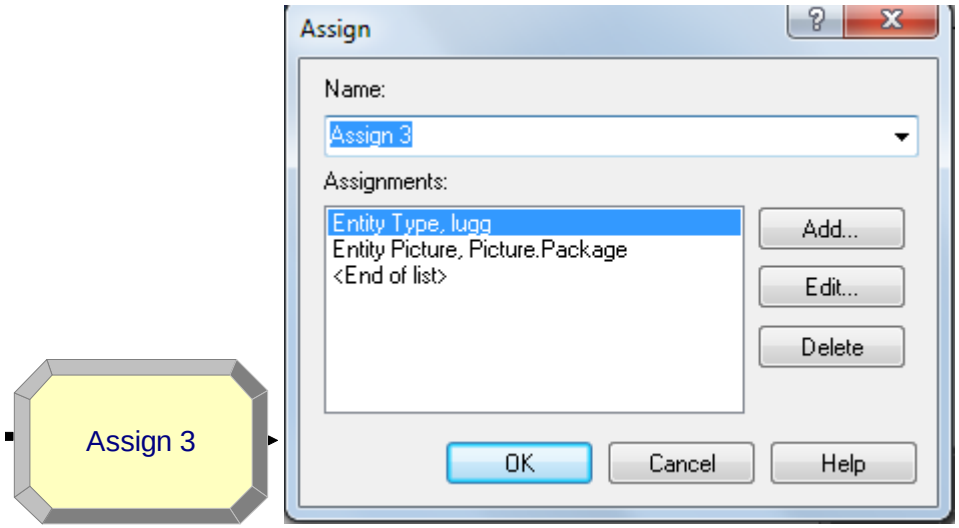
- As the people come out of the immigration process, the time taken by them is then recorded using the record module.



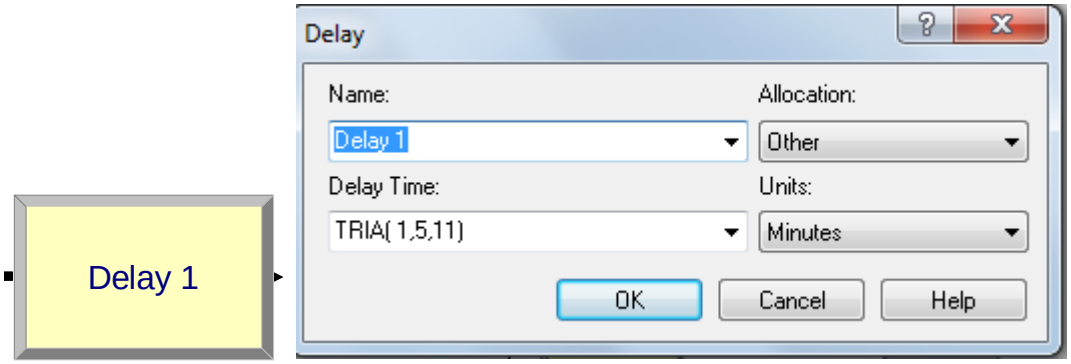
- After immigration, people enter the batch module so that they may find their respective luggage. But, before that they are assigned an attribute 'entryb' to record the time at which they enter the batch module. Also a variable 'disp2' with the value 'seq' is assigned here so that we can check which person entered the batch module. This assignment is done using the assign module.



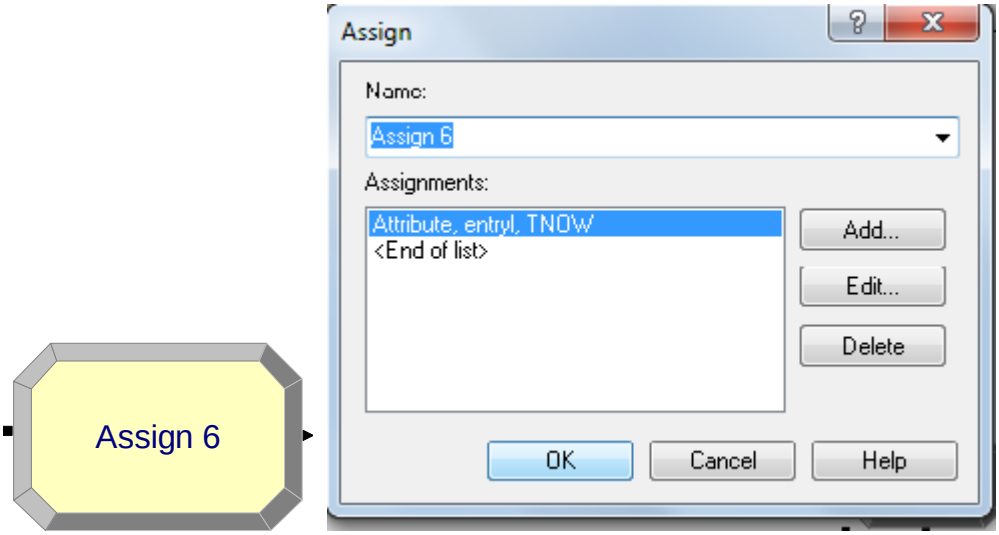
- When people are separated with their luggage, the luggage follows a different path. They first enter the assign module at which their entity type is assigned as 'luggage' and they are given an entity picture of a package.



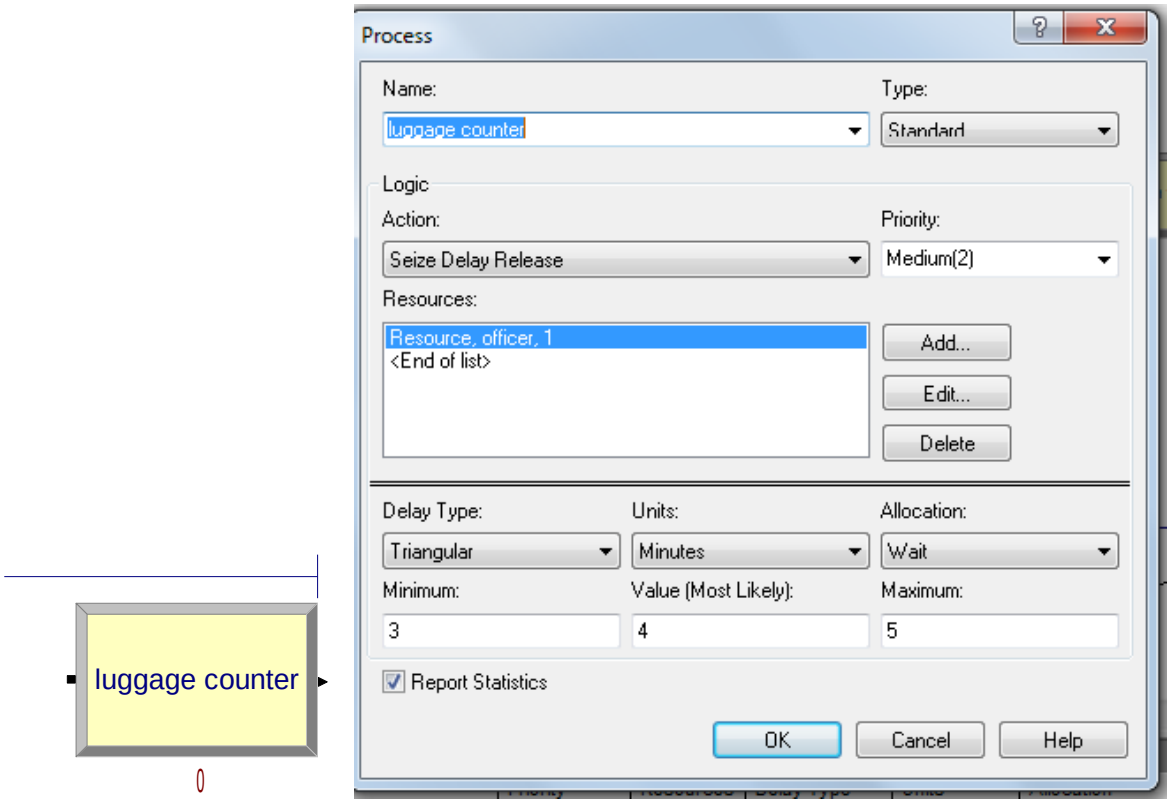
- Since in reality, both the luggage and people don't arrive at the same time, the luggage has been delayed using the delay module using a triangular distribution.



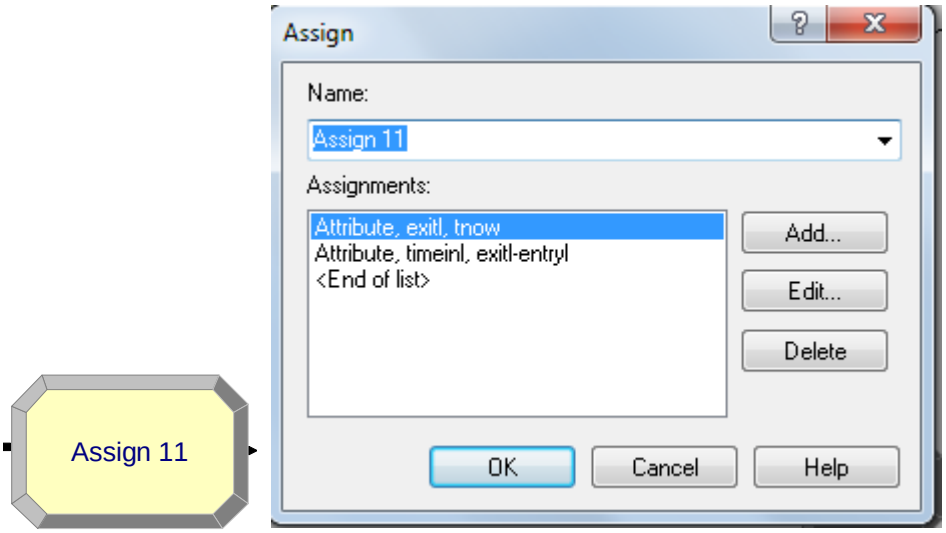
- Each luggage is then assigned the attribute ‘entryl’ to record their time of entry to the luggage counter.



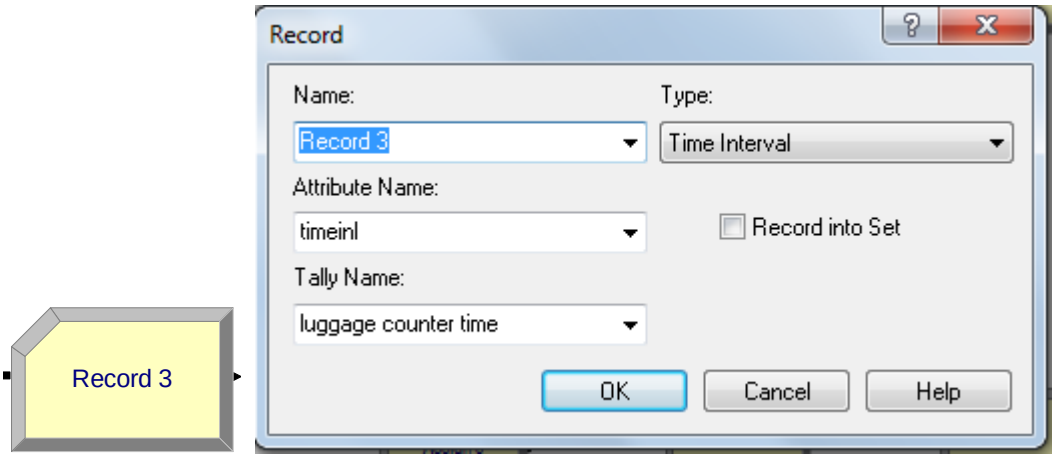
- At the luggage counter, the luggage is then processed and the delay is given a triangular distribution.



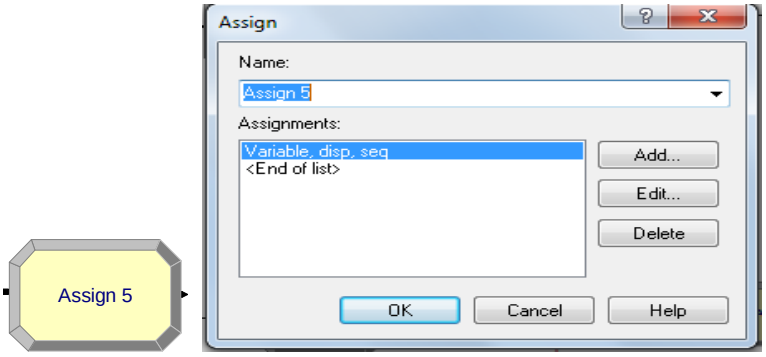
- The exit time from the luggage counter is then assigned as an attribute to each luggage and the time taken is calculated using the assign module.



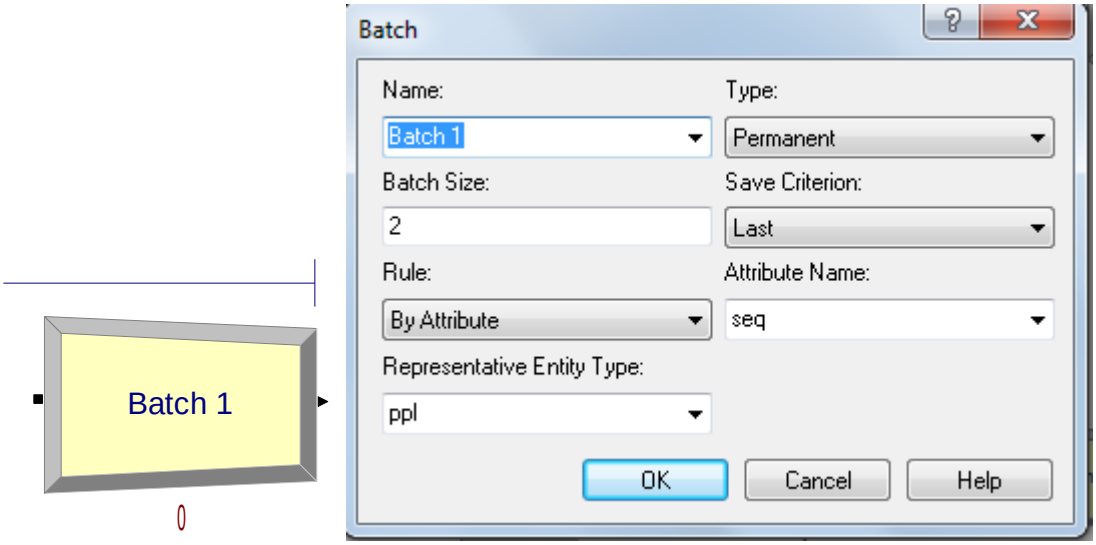
- The time taken at the luggage counter is then recorded using the record module.



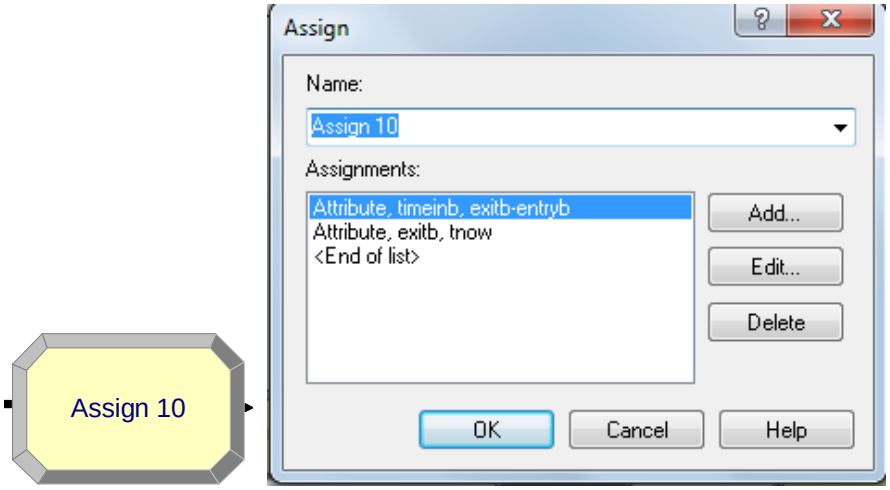
- Before proceeding for the batch process, a variable 'disp' has been assigned to show which luggage has arrived to the batch module.

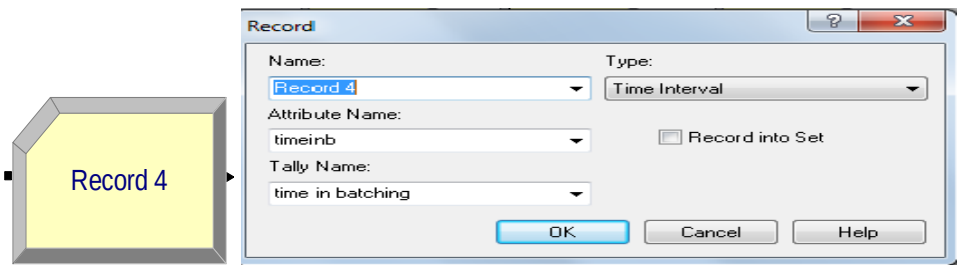


- At the batch module, people and their luggage are batched using the attribute ‘seq’ which they were assigned at the starting. The batch type is permanent because the people and the luggage don’t separate afterwards.

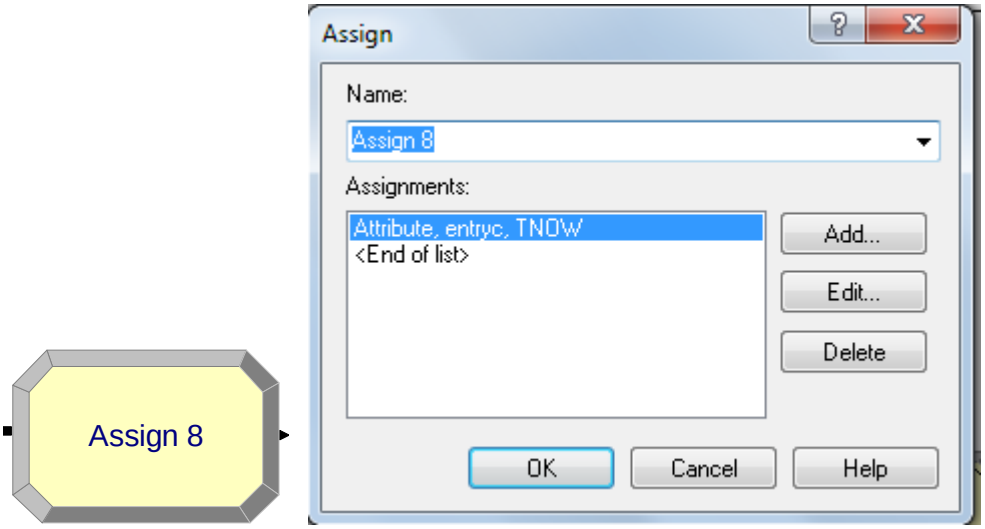


- After batching, an attribute named ‘exitb’ is assigned to record the exit time from the batch process using assign module and the time taken in batching is recorded using the record module.





- Before entering the custom process, the entity is then assigned an attribute to store the entry time at custom process.



- As the people enter the custom process, the process is defined as of type 'seize delay release'. This means that entities entering the process will seize the resource which will delay the process and then release it. Here the resource is the custom officer. The delay type is defined triangular here.

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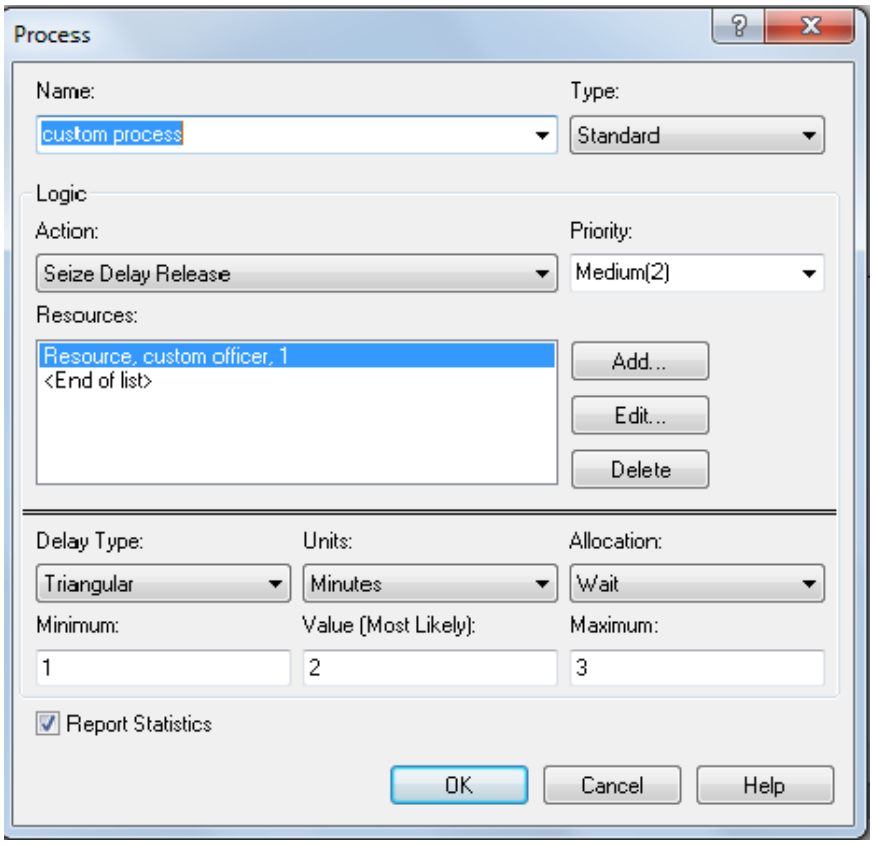
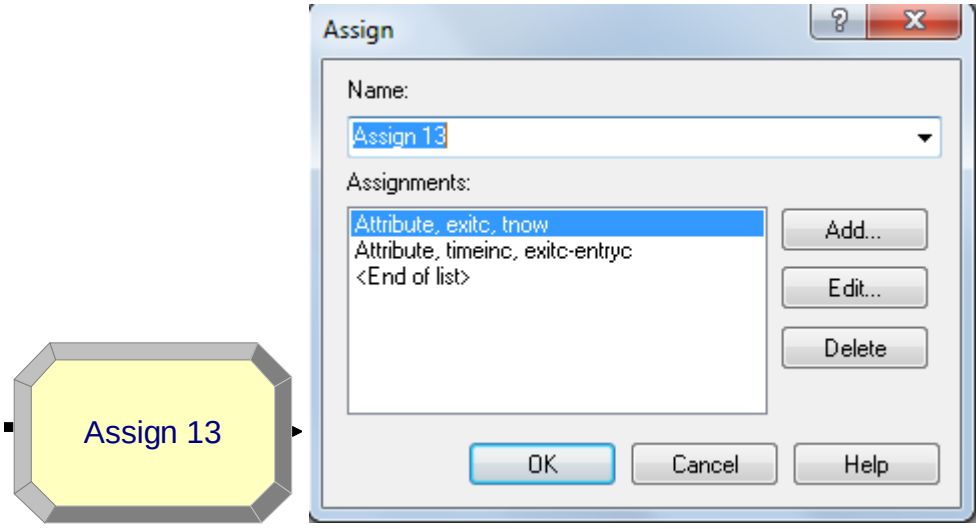
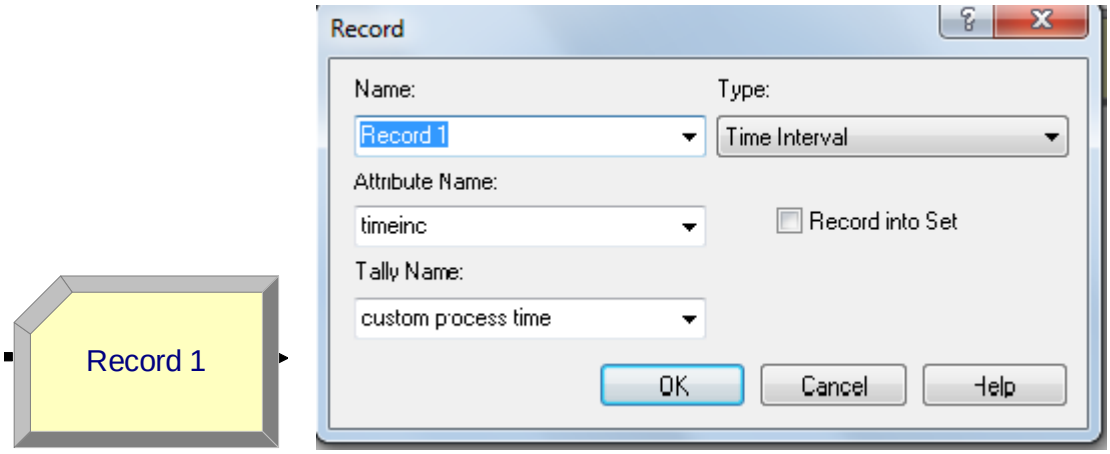
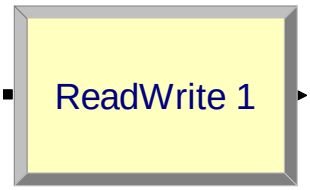


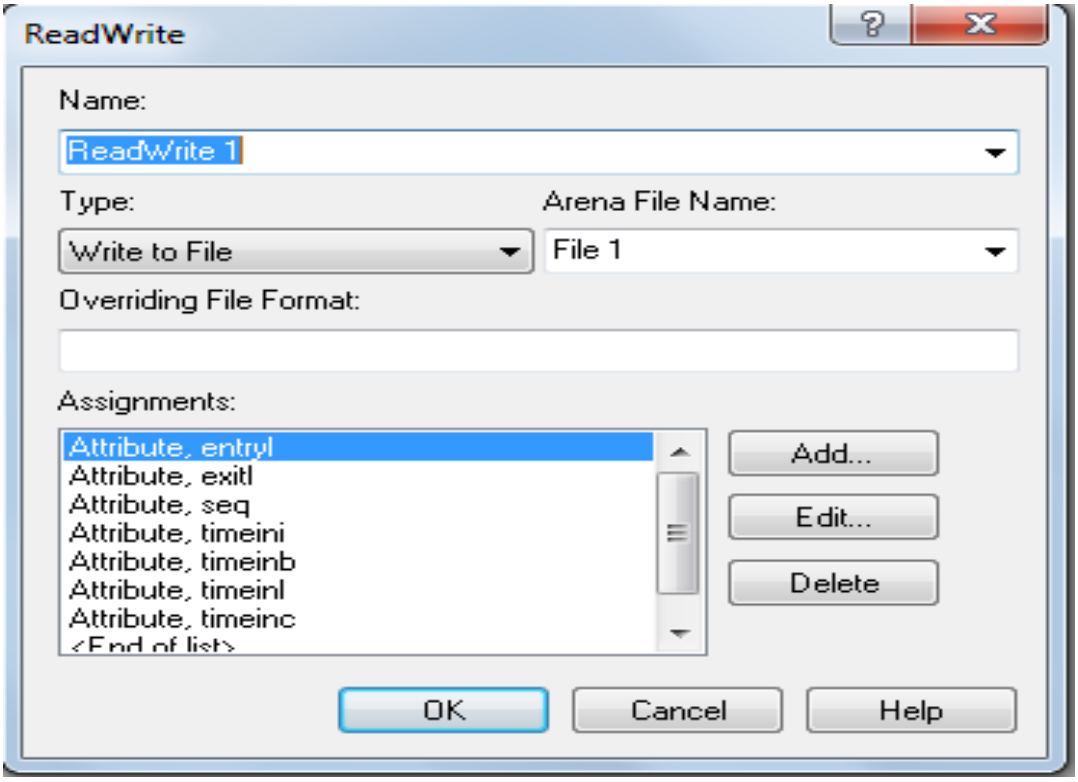
- People are then assigned an attribute to store the exit time from the custom process and to calculate the time taken .These readings are then recorded using the record module.

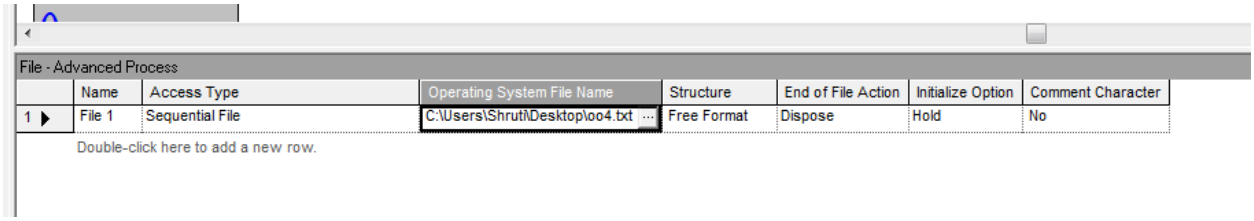




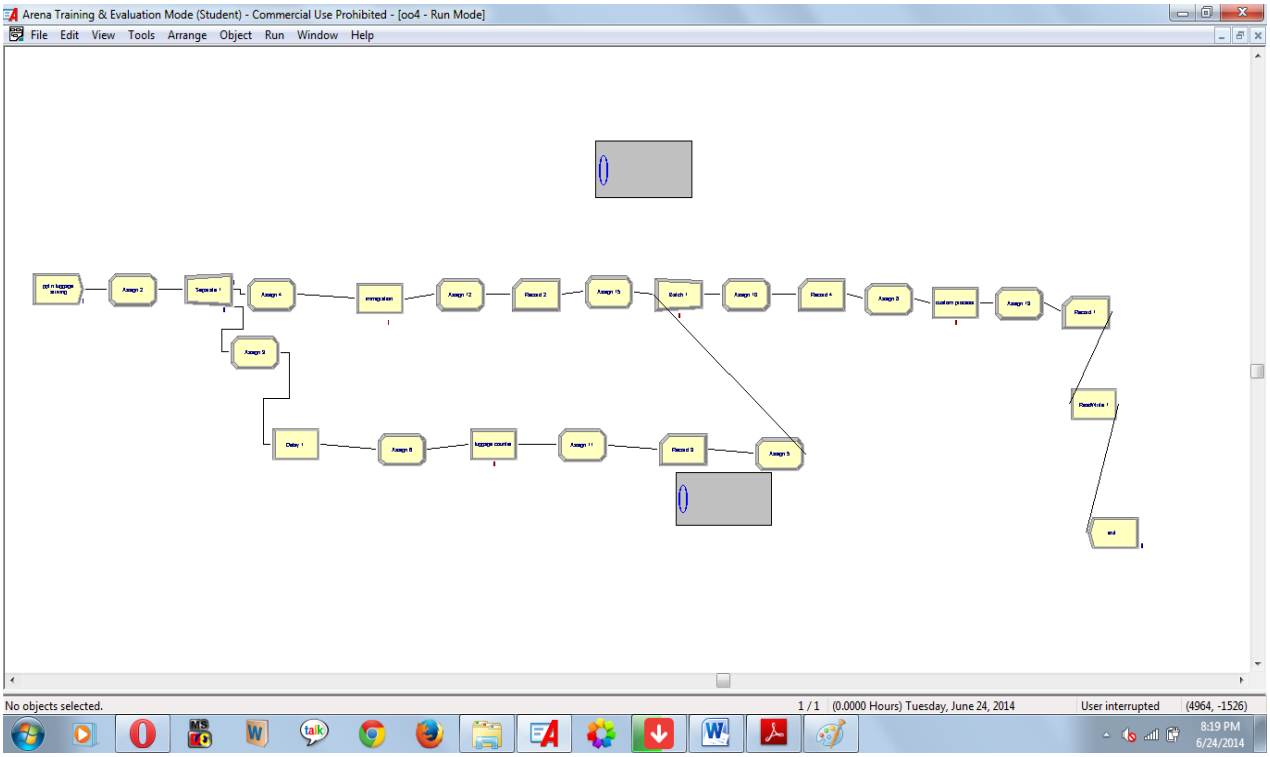
- All the readings taken are then stored in a sequential file which are then pulled in the excel sheets. To accomplish this task, read/write module is used.



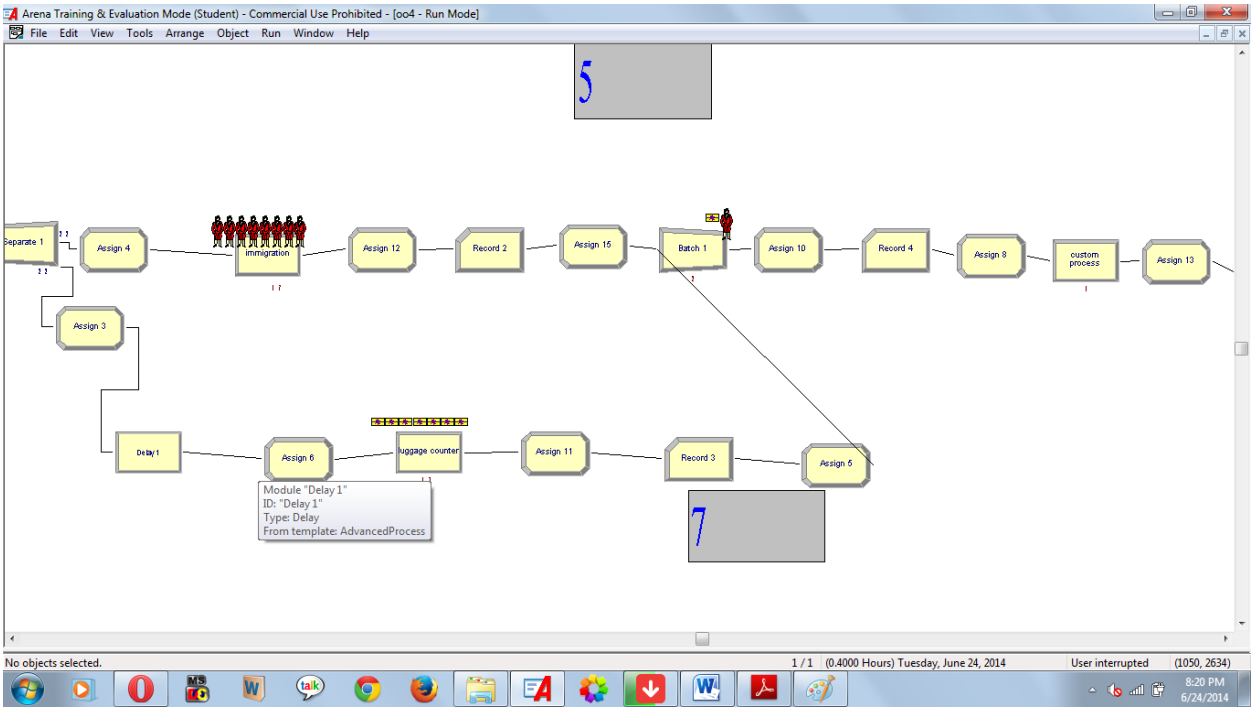




- So, in this model, the present scenario is depicted where people first enter the immigration counter after which they proceed towards the luggage counter to find their respective luggage and then they proceed towards custom process and then exit.



- After the simulation has been started, the model looks like this as shown below. Here it can be seen that a person is waiting for the luggage and the person whose luggage has already been arrived has not completed the immigration process yet.



- When the model run is complete, reports are generated which provide all the details of waiting time of the people at different processes, queue length and all other statistics regarding resources.

Resource

Usage

Total Number Seized	Value
custom officer	25.0000
imm officer	25.0000
officer	25.0000

User Specified

Tally

Interval	Average	Half Width	Minimum Value	Maximum Value
custom process time	1.0721	(Insufficient)	0.1450	2.0203
immigration process time	1.2479	(Insufficient)	0.07045402	2.4868
luggage counter time	0.3039	(Insufficient)	0.06062114	0.5990
time in batching	2.0399	(Insufficient)	0.1940	4.0405

Resource

Usage

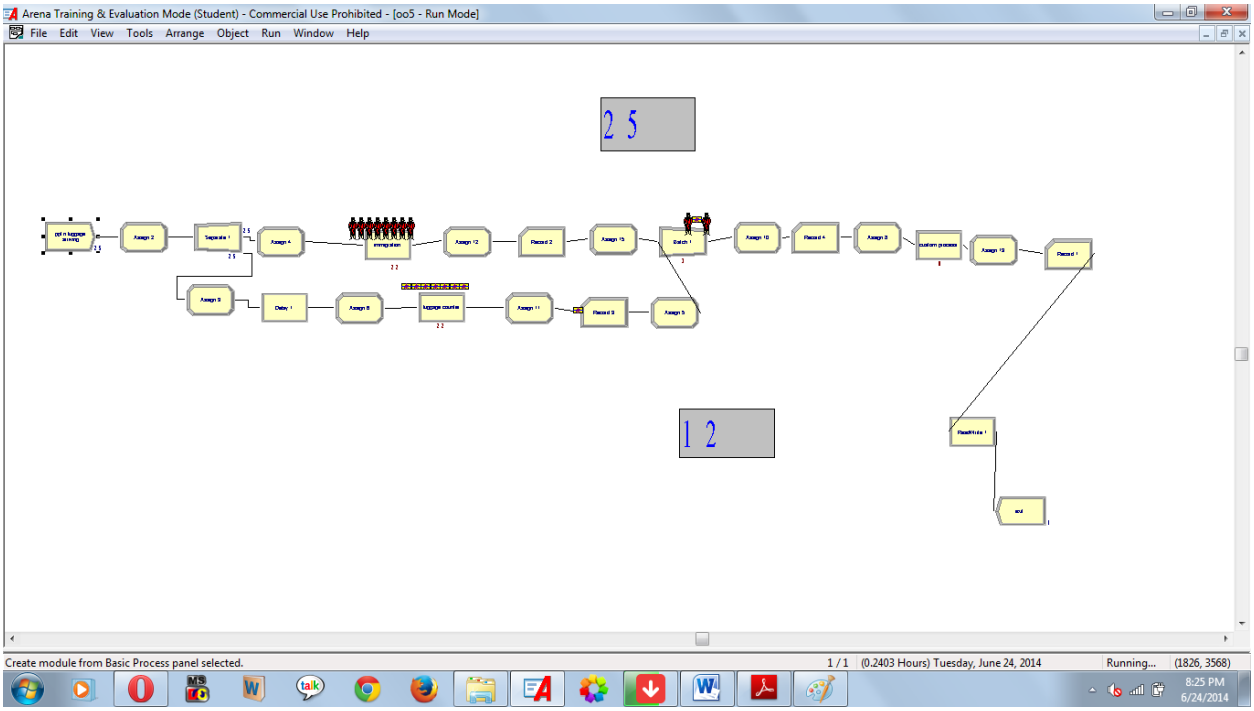
Instantaneous Utilization	Average	Half Width	Minimum Value	Maximum Value
custom officer	0.4035	(Insufficient)	0.00	1.0000
imm officer	0.9826	(Insufficient)	0.00	1.0000
officer	0.8099	(Insufficient)	0.00	1.0000

Number Busy	Average	Half Width	Minimum Value	Maximum Value
custom officer	0.4035	(Insufficient)	0.00	1.0000
imm officer	0.9826	(Insufficient)	0.00	1.0000
officer	0.8099	(Insufficient)	0.00	1.0000

Number Scheduled	Average	Half Width	Minimum Value	Maximum Value
custom officer	1.0000	(Insufficient)	1.0000	1.0000
imm officer	1.0000	(Insufficient)	1.0000	1.0000
officer	1.0000	(Insufficient)	1.0000	1.0000

Scheduled Utilization	Value
custom officer	0.4035
imm officer	0.9826
officer	0.8099

- The proposed model is then made in which as soon as the people arrive at the airport, they proceed towards the luggage counter which is then followed by the other processes like immigration and custom process.



- And similarly, here too the various reports regarding the average waiting time of the passengers at different processes obtained from the simulation model are analyzed.

Usage

Total Number Seized	Value
custom officer	25.0000
imm officer	25.0000
officer	25.0000

User Specified

Tally

Interval	Average	Half Width	Minimum Value	Maximum Value
custom process time	1.1910	(Insufficient)	0.1249	1.9657
immigration process time	0.9858	(Insufficient)	0.07045402	1.9657
luggage counter time	0.1024	(Insufficient)	0.04213927	0.1767
time in batching	1.9076	(Insufficient)	0.2498	3.9315

CONCLUSION

These models are thus helpful in studying the various situations at the Airport and to predict the performances. These simulation models will ensure that the average waiting time of a person waiting in the queues for several processes like immigration and customs is reduced.