Assignment 20

Response time of an e-commerce site

An e-commerce system has four types of requests: browsing clients (B), who read the catalog; purchasing clients (P), who perform transactions to buy goods; administration employees (A), who perform customer relations; and warehouse employees (W), who take care of packing and delivery goods. The arrival rates of clients, and the number and think times of employees are the following:

$\lambda_B = 10$ req./m. $\lambda_P = 3$ req./m.
$N_A = 10$ $Z_A = 5m$ $N_W = 15$ $Z_W = 10m$

Each request accesses the application server (1), the database (2) and the storage server (3), with the following demands:

$D_{1B} = 2$ s. $D_{1P} = 5$ s. $D_{1A} = 1$ s. $D_{1W} = 1.5$ s.
$D_{2B} = 3$ s. $D_{2P} = 1$ s. $D_{2A} = 2$ s. $D_{2W} = 2$ s.
$D_{3B} = 1$ s. $D_{3P} = 1.5$ s. $D_{3A} = 2$ s. $D_{3W} = 2.5$ s.

Using JMVA and direct computation, determine:

1. If the considered system is stable

2. The average system response time per class

3. The throughput of the closed classes

4. The average number of jobs of the open classes
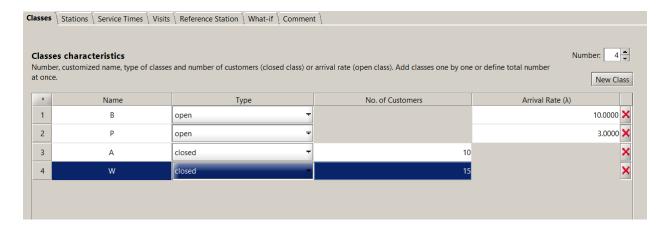
Take screen captures of the steps you performed in JMT

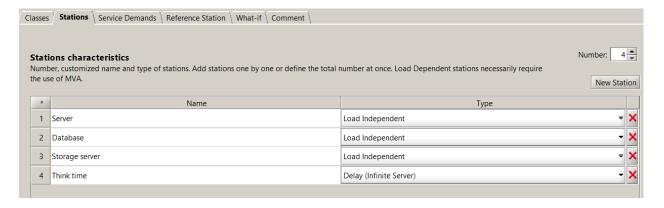SOLUTION

1) Transform the arrival rates measure into seconds

Lambda_b =0,1667 req/s

Assignment 20

Lambda_p = 0,05 req/s

2)

*	Name	Type	No. of Customers	Arrival Rate (λ)
1	B	open		10.0000
2	P	open		3.0000
3	A	closed	10	
4	W	closed	15	

Classes characteristics

Number, customized name, type of classes and number of customers (closed class) or arrival rate (open class). Add classes one by one or define total number at once.

Number: 4

3)

Stations characteristics

Number, customized name and type of stations. Add stations one by one or define the total number at once. Load Dependent stations necessarily require the use of MVA.

Number: 4

*	Name	Type
1	Server	Load Independent
2	Database	Load Independent
3	Storage server	Load Independent
4	Think time	Delay (Infinite Server)

4)

Service Demands

Input service demands of each station and class.
If the station is "Load Dependent" you can set the service demands for each number of customers by double-click on "LD Settings..." button.
Press "Service Times and Visits" button to enter service times and visits instead of service demands.

*	B	P	A	W
Server	2.0000	5.0000	1.0000	1.5000
Database	3.0000	1.0000	2.0000	2.0000
Storage ser..	1.0000	1.5000	2.0000	2.5000
Think time	0.0000	0.0000	300.0000	600.0000

5)

| Classes | Stations | Service Demands | **Reference Station** | What-if | Comment |

Reference Station

The station is used to compute the system throughput and the system response time for each **closed class**. Performance metrics of **open classes** are always computed with respect to the **arrival process**. Visits at the Reference station can not be Zero. **WARNING:** the reference station for all closed classes is forced to be the same station.

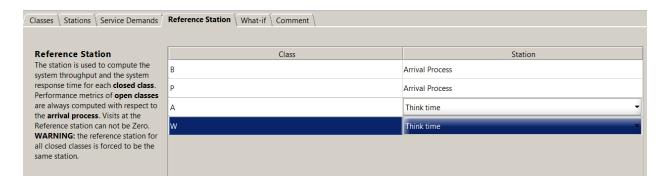| Class	Station
B	Arrival Process
P	Arrival Process
A	Think time
W	Think time

Results

System Response Time per class

System Response Time

The global aggregate is the "System Response Time" and is obtained weighting the aggregated values by the relative per-class throughput.
A: This value of System Response Time **includes** the Residence Time of the Reference Station.
B: This value of System Response Time **does NOT include** the Residence Time of the Reference Station.
Notice: For **open classes** the Reference Station always coincides with the arrival process. Thus the **B** values are not computed.

*	Aggregate	B	P	A	W
A	--	16.1796	19.6701	311.7689	614.0466

Throughput

Throughput

Throughput of each class for each station. System Throughput is the completion rate of the **Reference Station**.

*	Aggregate	B	P	A	W
System	0.2732	0.1667	0.0500	0.0321	0.0244
Server	0.2732	0.1667	0.0500	0.0321	0.0244
Database	0.2732	0.1667	0.0500	0.0321	0.0244
Storage s...	0.2732	0.1667	0.0500	0.0321	0.0244
Think time	0.2732	0.1667	0.0500	0.0321	0.0244

Average Number of Jobs

Assignment 20

Number of Customers

Average number of customers for each class at each station.

*	Aggregate	B	P	A	W
Aggregate	28.6806	2.6971	0.9835	10.0000	15.0000
Server	1.8701	0.9569	0.7175	0.0912	0.1044
Database	1.9541	1.4774	0.1477	0.1861	0.1430
Storage s...	0.5771	0.2629	0.1183	0.1002	0.0957
Think time	24.2794	0.0000	0.0000	9.6225	14.6569

Utilization

Utilization

Utilization of a customer class at the selected station. The utilization of a delay station is the average number of customers in the station (it may be greater than 1).

*	Aggregate	B	P	A	W
Server	0.6521	0.3334	0.2500	0.0321	0.0366
Database	0.6631	0.5001	0.0500	0.0642	0.0489
Storage s...	0.3669	0.1667	0.0750	0.0642	0.0611
Think time	24.2794	0.0000	0.0000	9.6225	14.6569

The system is stable because for every station, the utilization of the station is < 1