Flexsim: Global Table and Experimenter

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1. Global Table
2. Set Queue and Processor to a Group
3. Experimenter

Global Table and Experimenter

- Goal: To learn Global Table, Experimenter in Flexsim
- Problem: To estimate $E(W)$, $E(L)$, $E(W_q)$, and $E(L_q)$ for MM1 systems with inter-arrival rates λ and service rates μ listed below.

Cases	λ	μ	E(X)	E(S)	$E(W)$	$E(L)$	$E(W_q)$	$E(L_q)$
1	2	3	0.5	1/3	1	2	2/3	4/3
2	1	2	1	0.5	1.00	1.00	0.50	0.50
3	0.1	2	10	0.5	0.53	0.05	0.03	0.00
4	0.5	2	2	0.5	0.67	0.33	0.17	0.08
5	0.5	1	2	1	2.00	1.00	1.00	0.50

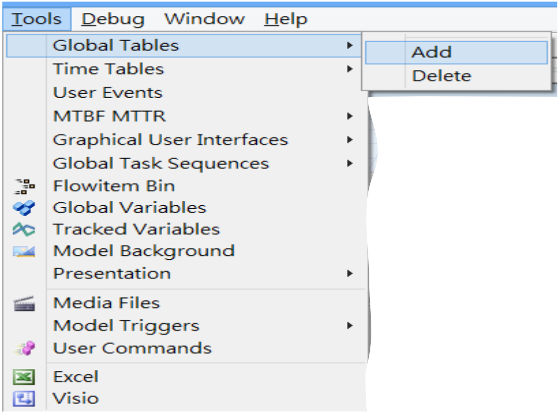
Figure : M/M/1 analytical solutions

- In Flexsim, you are asked to input the expected value of inter-arrival time, E(X), and the expected service time, E(S); instead of λ and μ. (hint: E(X) $= 1/\lambda$, E(S) $= 1/\beta$)

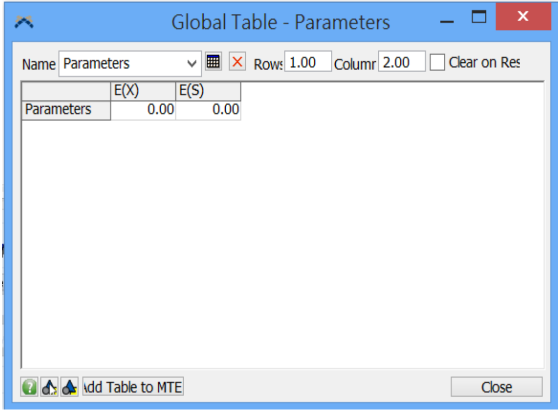
Ex: M/M/1: exponential(0, Mean_X, 0)

- "Tools > Global Tables > Add" (pp. 5-6)
  1. Add a table name, say "Parameters"
  2. Setup row no. (ex. 1) and column no. (ex. 2)
  3. Cell values can be "0". These cell values will be set up in
     "Statistics > Experimenter > Scenarios"
- "Source1 > Arrival Style (Inter-Arrival Time)". ex: exponential(0, Mean_X, 0) (Self-code is needed) (pp. 7-9)
- Set Queue and Processor to a Group (p. 13)
- "Statistics > Experimenter > Scenarios " (pp. 14-24)
  1. Scenarios: 5 scenarios
  2. Experiment Variables: Assume there are 2 variables (ex. E(X) and E(S))
  3. Variable: choosing values from list, then key in cell values
- "Statistics > Experimenter > Performance Measures"
  1. Name: ex. E(L_Q), E(W_Q)
  2. Label for y-axis: E(Queue Length), E(Wait Time in Queue)
  3. Performance Measure: choosing values from list (click twice).
- "Statistics > Experimenter > Experiment Run"
  1. Run Time: ex. 3600;
  2. Warmup Time: ex. 0
  3. Replications per Scenario: ex. 50

Add Global Table

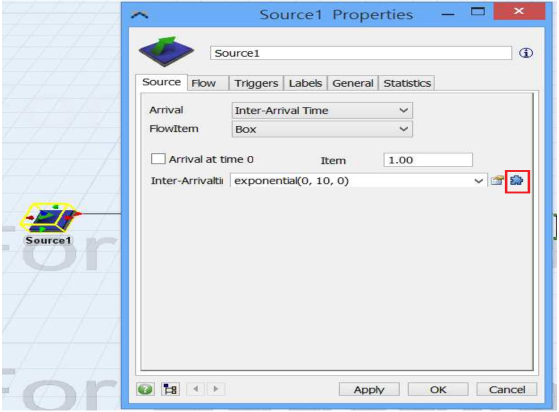


Add Global Table



	E(X)	E(S)
Parameters	0.00	0.00

Set mean inter-arrival time in Source



Source1 Properties

Source1

Source | Flow | Triggers | Labels | General | Statistics

Arrival: Inter-Arrival Time

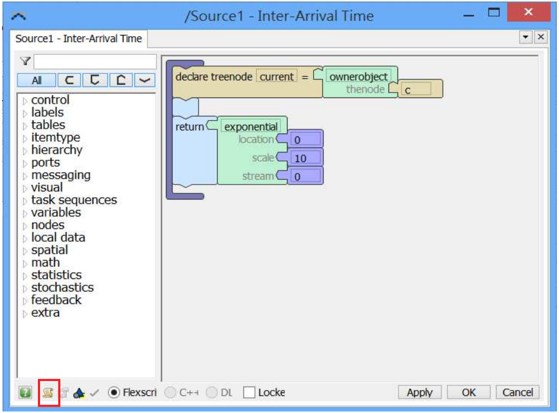
FlowItem: Box

☐ Arrival at time 0 Item 1.00

Inter-Arrivaltii: exponential(0, 10, 0)

- gettablenum("tablename", i-row, j-column)

Set mean inter-arrival time in Source

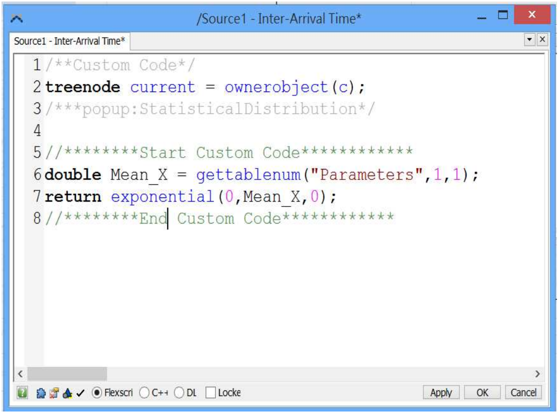


/Source1 - Inter-Arrival Time

```
declare treenode current = ownerobject thenode c
return exponential location 0 scale 10 stream 0
```

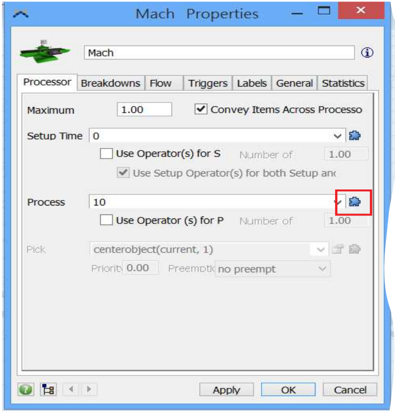
● Flexscri ○ C++ ○ DL □ Locke

Set mean inter-arrival time in Source


/Source1 - Inter-Arrival Time*
Source1 - Inter-Arrival Time*
● Flexscri ○ C++ ○ DL □ Locke
Apply
OK
Cancel

```
/**Custom Code*/
treenode current = ownerobject(c);
/***popup:StatisticalDistribution*/

//********Start Custom Code************
double Mean_X = gettablenum("Parameters",1,1);
return exponential(0,Mean_X,0);
//********End Custom Code************
```

Set mean service time in Processor



Mach

Maximum 1.00 ☑ Convey Items Across Processo

Setup Time 0

☐ Use Operator(s) for S Number of 1.00

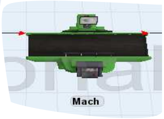
☑ Use Setup Operator(s) for both Setup an(

Process 10

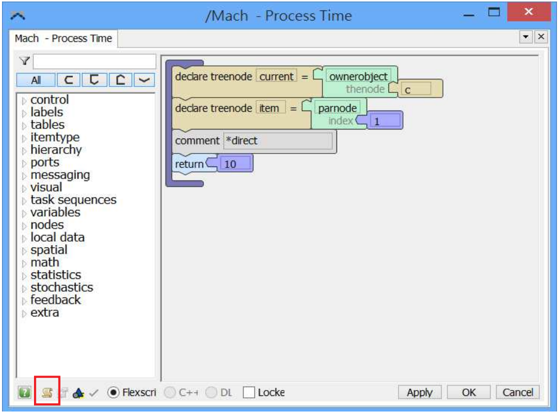
☐ Use Operator (s) for P Number of 1.00

Pick centerobject(current, 1)

Priorit 0.00 Preempti(no preempt

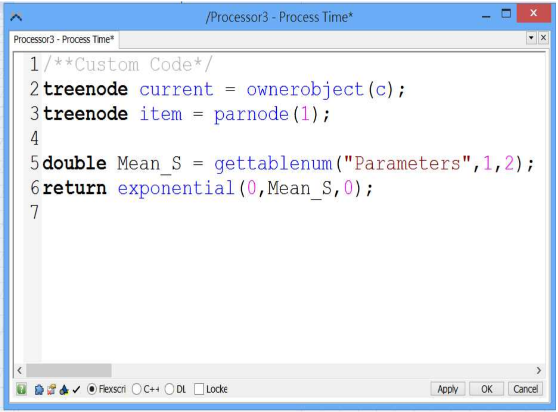


Set mean service time in Processor



```
declare treenode current = ownerobject thenode c
declare treenode item = parnode index 1
comment *direct
return 10
```

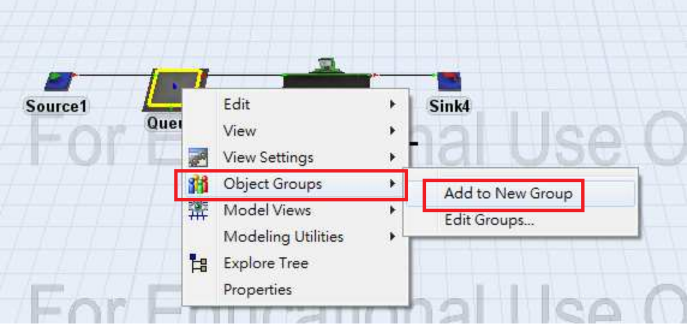
Set mean service time in Processor


/Processor3 - Process Time*
Processor3 - Process Time*
● Flexscri ○ C++ ○ DL □ Locke
Apply
OK
Cancel

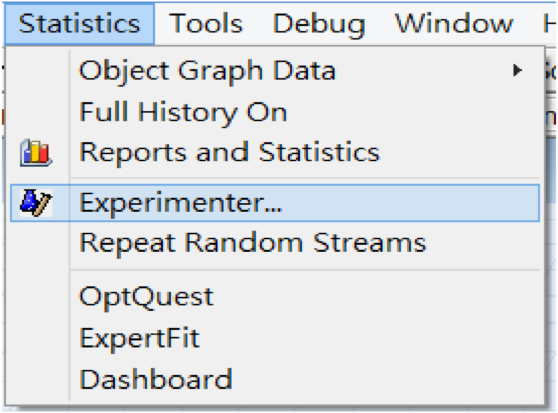
```
/**Custom Code*/
treenode current = ownerobject(c);
treenode item = parnode(1);

double Mean_S = gettablenum("Parameters",1,2);
return exponential(0,Mean_S,0);

```

Set Queue and Processor to a Group

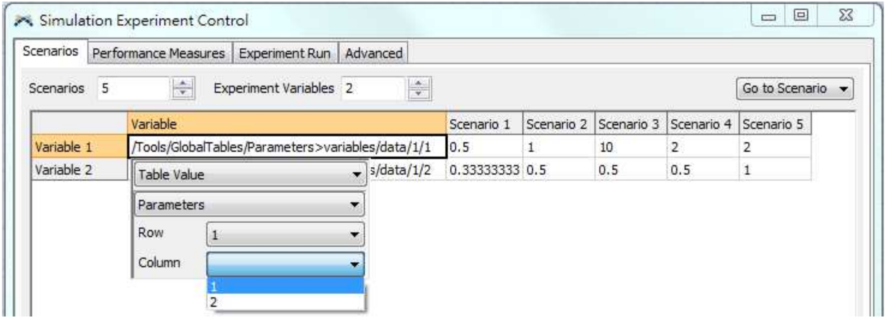
- 在 Queue 及 Processor 上按右鍵點選 Object Groups → Add to New Group



Experimenter



Experimenter - Set Scenarios



Simulation Experiment Control

Scenarios 5 Experiment Variables 2

	Variable	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Variable 1	/Tools/GlobalTables/Parameters>variables/data/1/1	0.5	1	10	2	2
Variable 2	s/data/1/2	0.33333333	0.5	0.5	0.5	1

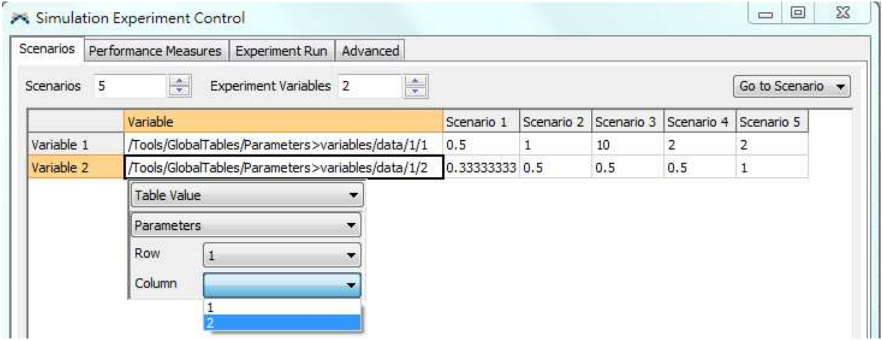
Table Value

Parameters

Row 1

Column

Experimenter - Set Scenarios



Scenarios 5 Experiment Variables 2

	Variable	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Variable 1	/Tools/GlobalTables/Parameters>variables/data/1/1	0.5	1	10	2	2
Variable 2	/Tools/GlobalTables/Parameters>variables/data/1/2	0.33333333	0.5	0.5	0.5	1

Table Value

Parameters

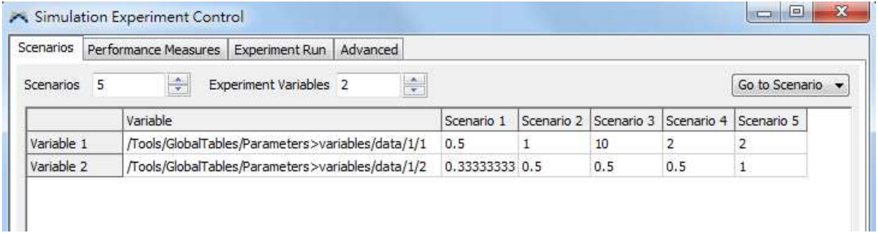
Row 1

Column

1

2

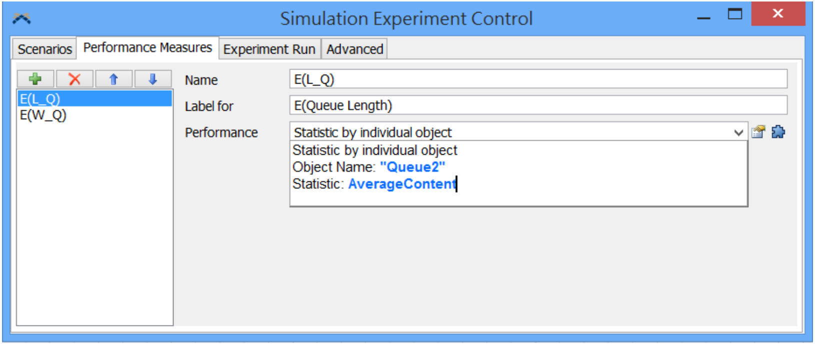
Experimenter - Set Scenarios



Scenarios 5 Experiment Variables 2

	Variable	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Variable 1	/Tools/GlobalTables/Parameters>variables/data/1/1	0.5	1	10	2	2
Variable 2	/Tools/GlobalTables/Parameters>variables/data/1/2	0.33333333	0.5	0.5	0.5	1

Experimenter - Set Performance Measures



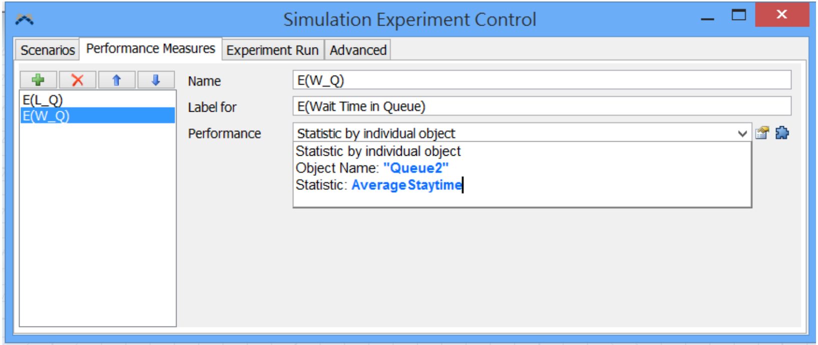
Name: E(L_Q)

Label for: E(Queue Length)

Performance: Statistic by individual object

Statistic by individual object
Object Name: "Queue2"
Statistic: AverageContent

Experimenter - Set Performance Measures



E(L_Q)
E(W_Q)

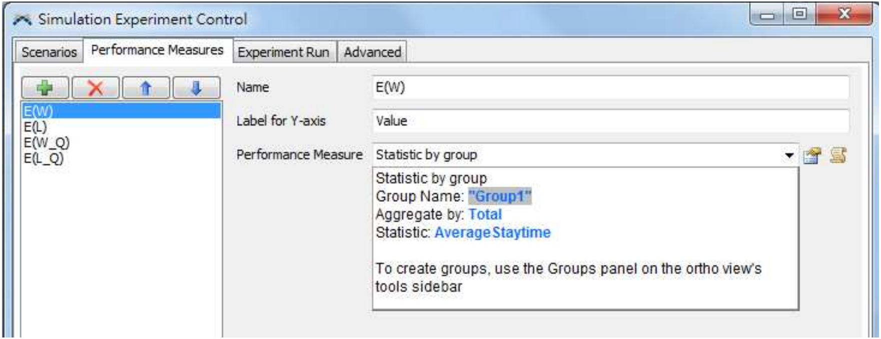
Name: E(W_Q)

Label for: E(Wait Time in Queue)

Performance: Statistic by individual object

Statistic by individual object
Object Name: "Queue2"
Statistic: AverageStaytime

Experimenter - Set Performance Measures



E(W)
E(L)
E(W_Q)
E(L_Q)

Name E(W)

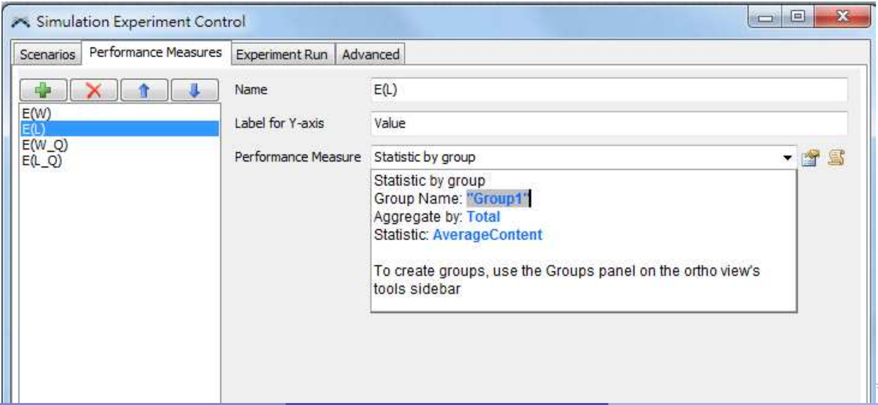
Label for Y-axis Value

Performance Measure Statistic by group

Statistic by group
Group Name: "Group1"
Aggregate by: Total
Statistic: AverageStaytime

To create groups, use the Groups panel on the ortho view's tools sidebar

Experimenter - Set Performance Measures



E(W)
E(L)
E(W_Q)
E(L_Q)

Name E(L)

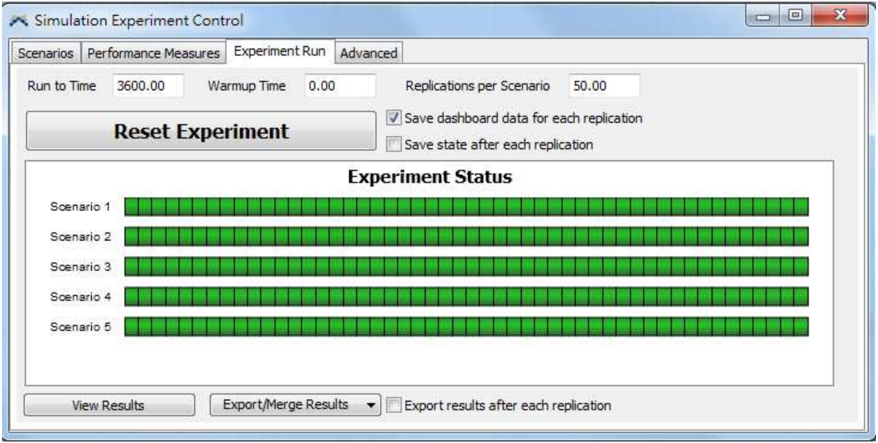
Label for Y-axis Value

Performance Measure Statistic by group

Statistic by group
Group Name: "Group1"
Aggregate by: Total
Statistic: AverageContent

To create groups, use the Groups panel on the ortho view's tools sidebar

Experimenter - Experiment Run



Simulation Experiment Control

Run to Time 3600.00 Warmup Time 0.00 Replications per Scenario 50.00

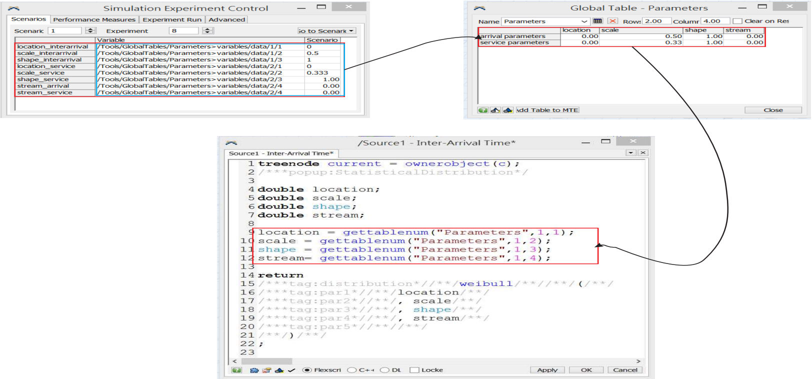
☑ Save dashboard data for each replication

□ Save state after each replication

Experiment Status

□ Export results after each replication

Experimenter Execution Sequence



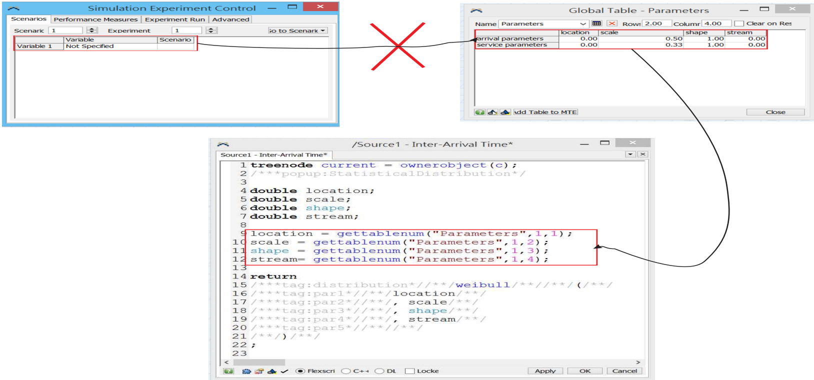
	Variable	Scenario
location_interarrival	/Tools/GlobalTables/Parameters>variables/data/1/1	0
scale_interarrival	/Tools/GlobalTables/Parameters>variables/data/1/2	0.5
shape_interarrival	/Tools/GlobalTables/Parameters>variables/data/1/3	1
location_service	/Tools/GlobalTables/Parameters>variables/data/2/1	0
scale_service	/Tools/GlobalTables/Parameters>variables/data/2/2	0.333
shape_service	/Tools/GlobalTables/Parameters>variables/data/2/3	1.00
stream_arrival	/Tools/GlobalTables/Parameters>variables/data/2/4	0.00
stream_service	/Tools/GlobalTables/Parameters>variables/data/2/4	0.00

	location	scale	shape	stream
arrival parameters	0.00	0.50	1.00	0.00
service parameters	0.00	0.33	1.00	0.00

```
treenode current = ownerobject(c);
/***popup:StatisticalDistribution*/

double location;
double scale;
double shape;
double stream;

location = gettablenum("Parameters",1,1);
scale = gettablenum("Parameters",1,2);
shape = gettablenum("Parameters",1,3);
stream= gettablenum("Parameters",1,4);

return
/***tag:distribution*//**/weibull/**//**/(/**/
/***tag:par1*//**/location/**/
/***tag:par2*//**/, scale/**/
/***tag:par3*//**/, shape/**/
/***tag:par4*//**/, stream/**/
/***tag:par5*//**//**/
/**/)/**/
;
```

- Sequence-1: Set values from Experimenter Scenarios into GlobalTable
- Sequence-2: Object get values from GlobalTable

Experimenter Execution Sequence



Simulation Experiment Control

Scenario 1 Experiment 1

	Variable	Scenario
Variable 1	Not Specified	

Global Table - Parameters

Name Parameters Rows 2.00 Columns 4.00 □ Clear on Reset

	location	scale	shape	stream
arrival parameters	0.00	0.50	1.00	0.00
service parameters	0.00	0.33	1.00	0.00

/Source1 - Inter-Arrival Time*

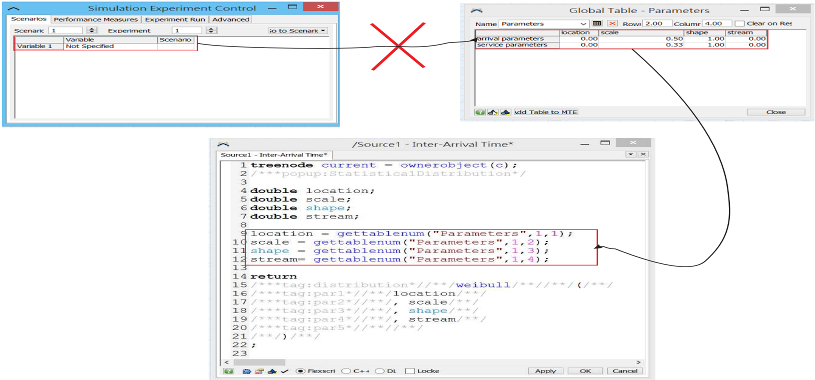
Source1 - Inter-Arrival Time*

```
treenode current = ownerobject(c);
/***popup:StatisticalDistribution*/

double location;
double scale;
double shape;
double stream;

location = gettablenum("Parameters",1,1);
scale = gettablenum("Parameters",1,2);
shape = gettablenum("Parameters",1,3);
stream= gettablenum("Parameters",1,4);

return
/***tag:distribution*//**/weibull/**//**/(/**/
/***tag:par1*//**/location/**/
/***tag:par2*//**/, scale/**/
/***tag:par3*//**/, shape/**/
/***tag:par4*//**/, stream/**/
/***tag:par5*//**//**/
/**/)/**/
;
```

◉ Flexscript ○ C++ ○ DLL □ Locked

- Sequence-1: Set values from Experimenter Scenarios into GlobalTable
- Sequence-2: Object get values from GlobalTable
- Q:What if there is no Scenarios?

Experimenter Execution Sequence


Simulation Experiment Control
Scenarios
Performance Measures
Experiment Run
Advanced
Go to Scenario
Global Table - Parameters
Add Table to MTE
Close
/Source1 - Inter-Arrival Time*
Source1 - Inter-Arrival Time*
Apply
OK
Cancel

Scenario 1 Experiment 1

	Variable	Scenario
Variable 1	Not Specified	

Name Parameters Rows 2.00 Columns 4.00 □ Clear on Reset

	location	scale	shape	stream
arrival parameters	0.00	0.50	1.00	0.00
service parameters	0.00	0.33	1.00	0.00

```
treenode current = ownerobject(c);
/***popup:StatisticalDistribution*/

double location;
double scale;
double shape;
double stream;

location = gettablenum("Parameters",1,1);
scale = gettablenum("Parameters",1,2);
shape = gettablenum("Parameters",1,3);
stream= gettablenum("Parameters",1,4);

return
/***tag:distribution*//**/weibull/**//**/(/**/
/***tag:par1*//**/location/**/
/***tag:par2*//**/, scale/**/
/***tag:par3*//**/, shape/**/
/***tag:par4*//**/, stream/**/
/***tag:par5*//**//**/
/**/)/**/
;

```

● Flexscript ○ C++ ○ DLL □ Locked

- Sequence-1: Set values from Experimenter Scenarios into GlobalTable
- Sequence-2: Object get values from GlobalTable
- Q:What if there is no Scenarios?
- A:Then Object will directly get values from GlobalTable