**Information Systems Modeling and Simulation**

**IS462**

***Problem #1***

Assuming the arrival time and service times calculated in problem 1, where the following table represents the memory area for a simulation system. Three linked lists should be maintained. The three lists are

* Events List – head at memory location 1
* Empty List - head at memory location 2
* Queue List - head at memory location 3

**Memory Area**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Memory****Location** | **ID** | **Event notice (event type)** | **Event time (in Minutes)** | **Next Event** |
| **1** | **1** | **End Service** | **7:12** | **5** |
| **2** |  |  |  | **4** |
| **3** | **2** | **--** | **--** | **7** |
| **4** |  |  |  | **6** |
| **5** | **4** | **New Arrival** | **7:15** | **0** |
| **6** |  |  |  | **0** |
| **7** | **3** | **--** | **--** | **0** |

where

|  |  |
| --- | --- |
| ***Next Job #*** | ***Inter Arrival Time******(in Seconds)*** |
| 1 | 2 |
| 2 | 3 |
| 3 | 4 |

|  |  |
| --- | --- |
| ***Next Job #*** | ***Service Time******(in Seconds)*** |
| 1 | 4 |
| 2 | 3 |
| 3 | 2 |

Show how the memory area will look like after processing the 3 next events.

**Solutions**

**Memory Area after first event**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Memory****Location** | **ID** | **Event notice (event type)** | **Event time** | **Next Event** |
| **1** |  |  |  | **0** |
| **2** |  |  |  | **4** |
| **3** | **2** | **End Service** | **7:16** | **0** |
| **4** |  |  |  | **6** |
| **5** | **4** | **New Arrival** | **7:15** | **3** |
| **6** |  |  |  | **1** |
| **7** | **3** | **--** | **--** | **0** |

* Events List – head at memory location **5**
* Empty List - head at memory location 2
* Queue List - head at memory location 7

**Memory Area after second event**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Memory****Location** | **ID** | **Event notice (event type)** | **Event time** | **Next Event** |
| **1** |  |  |  | **0** |
| **2** | **5** | **New Arrival** | **7:17** | **0** |
| **3** | **2** | **End Service** | **7:16** | **2** |
| **4** |  |  |  | **6** |
| **5** | **4** | **--** | **--** | **0** |
| **6** |  |  |  | **1** |
| **7** | **3** | **--** | **--** | **5** |

* Events List – head at memory location 3
* Empty List - head at memory location 4
* Queue List - head at memory location 7

**Memory Area after third event**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Memory****Location** | **ID** | **Event notice (event type)** | **Event time** | **Next Event** |
| **1** |  |  |  | **3** |
| **2** | **5** | **New Arrival** | **7:17** | **7** |
| **3** |  |  |  | **0** |
| **4** |  |  |  | **6** |
| **5** | **4** | **--** | **--** | **0** |
| **6** |  |  |  | **1** |
| **7** | **3** | **End Service** | **7:19** | **0** |

* Events List – head at memory location 2
* Empty List - head at memory location 4
* Queue List - head at memory location **5**

**Problem 2:**

Assume an M/M/1 system, where the inter-arrival time mean value is 7minutes and the service time mean value is 5 minutes. Using the random values given in the table below, and for the first 3 arrivals, find

* Time weighted Average number of customers in queue***(3 points)***
* Time weighted Average number of customers in system***(3 points)***
* Average time in system***(3 points)***

Where

$$x=-λ ln(R)$$

and

|  |  |
| --- | --- |
| ***R*** | ***-ln (R)*** |
| 0.15 | 1.90 |
| 0.62 | 0.48 |
| 0.70 | 0.36 |
| 0.28 | 1.27 |
| 0.32 | 1.14 |
| 0.75 | 0.29 |

Calculate to the nearest 2 digits after point.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Job #** | **Arrival Time** | **Queue length** | **Waiting Time in Queue** | **Service Time** | **Service Begins** | **Service Ends** | **Time in System** |
| 1 | 13.3 | 0 | 0 | 2.4 | 13.3 | 15.7 | 2.4 |
| 2 | 15.82 | 0 | 0 | 6.35 | 15.82 | 22.17 | 6.35 |
| 3 | 23.8 | 0 | 0 | 1.45 | 23.8 | 25.25 | 1.45 |

Time weighted Average number of customers in queue ***= 0***

Time weighted Average number of customers in system ***=1***

Average time in system= 3.4 min

***Problem 3***

Assuming problem 3, where the following table represents the memory area for a simulation system. Three linked lists should be maintained. The three lists are

* Events List – head at memory location 0
* Empty List - head at memory location 1
* Queue List - head at memory location 0

Show how the memory area will look like after processing the 3 next events.Calculate to the nearest 2 digits after point.

**Initial Memory Area (Don’t fill)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Memory****Location** | **ID** | **Event notice (event type)** | **Event time** | **Next Event** |
| **1** |  |  |  | **2** |
| **2** |  |  |  | **3** |
| **3** |  |  |  | **4** |
| **4** |  |  |  | **5** |
| **5** |  |  |  | **6** |
| **6** |  |  |  | **7** |
| **7** |  |  |  | **0** |

**Memory Area after first event**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Memory****Location** | **ID** | **Event notice (event type)** | **Event time** | **Next Event** |
| **1** | **1** | **New Arrival** | 13.3 | **0** |
| **2** |  |  |  | **3** |
| **3** |  |  |  | **4** |
| **4** |  |  |  | **5** |
| **5** |  |  |  | **6** |
| **6** |  |  |  | **7** |
| **7** |  |  |  | **0** |

* Events List – head at memory location 1
* Empty List - head at memory location 2
* Queue List - head at memory location 0

**Memory Area after second event**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Memory****Location** | **ID** | **Event notice (event type)** | **Event time** | **Next Event** |
| **1** | **1** | **End Service** | **15.7** | **1** |
| **2** | **2** | **New Arrival** | 15.82 | **0** |
| **3** |  |  |  | **4** |
| **4** |  |  |  | **5** |
| **5** |  |  |  | **6** |
| **6** |  |  |  | **7** |
| **7** |  |  |  | **0** |

* Events List – head at memory location 1
* Empty List - head at memory location 3
* Queue List - head at memory location 0

**Memory Area after third event**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Memory****Location** | **ID** | **Event notice (event type)** | **Event time** | **Next Event** |
| **1** |  |  |  | **0** |
| **2** | **2** | **New Arrival** | 15.82 | **0** |
| **3** |  |  |  | **4** |
| **4** |  |  |  | **5** |
| **5** |  |  |  | **6** |
| **6** |  |  |  | **7** |
| **7** |  |  |  | **1** |

* Events List – head at memory location 2
* Empty List - head at memory location 3
* Queue List - head at memory location 0