**Department of Industrial and Systems Engineering**

**Indian Institute of Technology, Kharagpur**

**Simulation Lab**

**Time-2:00 pm to 5:00 pm Date: 04/02/2020**

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**Practice Problems:**

1. A Xerox center has one fast copier and one slow copier. The copy time per pager for the fast copier is normally distributed with mean 1.6 seconds and standard deviation 0.3 seconds. The copy time per page for the slow copier is normally distributed with mean 2.8 seconds and standard deviation 0.6 seconds. The arrival process is Poisson, so the inter arrival time distribution for customers is exponential, with mean 3.0 minutes. The number of copies requested by each customer is uniformly distributed between 10 and 50 copies. The policy for selecting a copier is as follows: If the number of copies requested is less than or equal to 30, the slow copier will be used. If the number of copies exceeds 30, the fast copier is used, with one exception: If no jobs are in progress on the slow copier and the number of jobs waiting for the fast copier is at least two, then the customer will be served by slow copier. After the customer gives the originals for copying, she should proceeds to the service counter to pay for the copying. The time to complete the payment transaction is normally distributed with mean 2.1 minutes and standard deviation 0.6 minutes. As soon as both payment and the copying are finished, the customer takes the copies and departs the copying centre. The copy center works 10 hours per day for 5 replications. Management has requested the model to be developed because they concerned that customers have to wait too long for copies. Recently, several customers complained about long waitings. Their standard is that customers waiting time should average no more than 3 minutes. If the mean waiting time is too long, several options are available: The policy for allocating jobs to the fast copier could be modified or the company could purchase an additional copier which could be either a slow copier or a fast copier.

[No. of copies<=30] || [No. of copies >30 && Use slow copier.WIP==0 &&NQ[use of fast copier.queue]>=2]

1. Suppose production orders for tie-dye T-shirts arrive to a production facility according toaExponential process with a mean rate of 1 per hour. There are two basic psychedelic designsinvolving either red or blue dye. For some reason, the blue shirts are a little more popularthan the red shirts so that when an order arrives, about 70% of the time it is for the bluedye designs. In addition, there are two different package sizes for the shirts, 3 and 5 units.There is a 25% chance that the order will be for a package size of 5 and a 75% chance thatthe order will be for a package size of 3. Each of the shirts must be individually handmadeto the customer’s order design specifications. The time to produce a shirt (of either color) isuniformly distributed within the range of 15–25 minutes. There are currently two workerswho are setup to make either shirt. When an order arrives to the facility, its type (red orblue) is determined and the pack size is determined. Then, the appropriate number of white(un-dyed) shirts is sent to the shirt makers with a note pinned to the shirt indicating thecustomer order, its basic design, and the pack size for the order. Meanwhile, the paperworkfor the order is processed and a customized packaging letter and box is prepared to holdthe order. It takes another worker between 8 and 10 minutes to make the box and print acustom thank you note. After the packaging is made, it waits prior to final inspection for theshirts associated with the order. After the shirts are combined with the packaging, they areinspected by the packagingworker which is distributed according to a triangular distributionwith a minimum of 5 minutes, a most likely value of 10 minutes, and a maximum value of15 minutes. Finally, the boxed customer order is sent to shipping.