Homework 2: This problem is adapted from "Operating Systems, 4th Ed.", William Stallings, Prentice Hall, 2001.

Santa Claus sleeps in his shop at the North Pole. His nine reindeer are all on vacation in the South Pacific, while his elves are busy making toys to be given to the children. As Christmas draws near, the reindeer return one by one from their vacation. When the last one arrives, the simulation ends. It is observed that the reindeer arrive at the North Pole with arrivals distributed according to the Poisson distribution. On average, 12 hours pass between the reindeers' arrivals. You can assume that as soon as a reindeer arrives at the Noth Pole he leaves the model.

Santa Claus can be awakened from his sleep by the elves having difficulty making toys. It is observed that the arrivals of the elves at Santa's door is distributed according to the Poisson distribution and on average 30 minutes pass between the elves' arrivals.

The elves make four different types of toys. These types are designated as T1, T2, T3 and T4. The observed frequencies of the elves coming to ask for Santa's help for each type of toy is given in Table-1. Table-2 lists the expected service times of Santa for each toy type. These service times follow the Erlang distribution.

There is a waiting room with a capacity of three seats in front of Santa's room. The elves wait here for their turn to visit Santa. When a new elf arrives, if the waiting room is full, the elf leaves and does not come back. After an elf leaves Santa's room, he leaves the model.

Sometimes Santa's wife requires to speak with Santa regarding family matters. When she arrives to speak with Santa, she has a higher priority than the elves. It is observed that her visiting times is uniformly distributed between [1,5] hours. During each visit, she remains in the room for a duration of time distributed uniformly between [5,15] minutes. If the waiting room is full, she waits.

Every 4 hours Santa takes a break for 10 minutes. During this time he becomes unavailable and neither the elves nor his wife can enter his room. After 10 minutes, he again becomes available to accept visits from his wife and the elves. We can assume that there are exactly 9 reindeer, but there may be any number of elves. Simulate the system described above using GPSS/World.

Table -1: Relative frequencies of elves arriving with questions regarding each type of toy

Toy type	Relative frequency
T1	0.30
T2	0.15
T3	0.05
T4	0.50

Table-2: Expected service times Santa needs to help with questions for each toy type

Toy type	Expected service time (minutes)
T1	20
T2	40
T3	60
T4	30