1 Laboratory Nr 5: Simulation of simple service systems

1. Simulation of $M/M/c$ -blocking process .

   (a) Simulate Poisson process on the interval $< 0, 100 >$ with intensities $\lambda = 10$, 25 and 35 .

   (b) For each arrival generate its service time (i.e. a realization of exponential, random variable with parameter $\mu = 1$)

   (c) Assume $c = 10$, 20. Simulate $M/M/c$ -blocking system, i.e. for each arrival generate a number of the server (from the range $1, .., c$) an arrival will be served with. Each number is kept by random exponentially distributed (selected already) service time. At fixed time number of a server is selected only from the available servers (i.e. not occupied). If all servers are busy then arrival is marked as lost. Calculate the proportion of lost arrivals to total number of arrivals by simulating say 1000 realizations of the process. Calculate the mean and compare it with the number $\frac{\lambda^c}{c!} / \sum_{i=0}^{c} \frac{\lambda^i}{i!}$

2. Simulation of $M/M/1$ -queuing process

   (a) Simulate Poisson process on the interval $< 0, 100 >$ with intensities $\lambda = .1$, .5, and .8 .

   (b) For each arrival generate its service time (i.e. a realization of exponential, random variable with parameter $\mu = 1$).

   (c) If the server is busy an arrival is in the state of waiting. The number of arrivals with waiting state at t is the size of the queue at $t \in < 1, 100 >$. Draw picture *size of queue at t* versus t.

   (d) Repeat point c. 100 times and find approximation of expectation of *number of clients in the system* .

   (e) Compare this obtained estimates with theoretical values obtained from the formula $\lambda/(1 - \lambda)$:

3. Write short description of what have you done and observed and submit it in pdf format by E-mail: pjsz@hotmail.com