Assignment 1a

The purpose of this assignment was to simulate a coffee house with simulations of different queuing strategies and number of service registers. We were given the following data:

- In average 12 customers arrive per hour

- Each customer needs 4 minutes service time on average.

- Open from 8:00am - 8:00pm

- M/M/1/∞/∞/FIFO

- A/B/S/K/N/D

A = the interarrival time distribution

B = the service time distribution

S = the number of servers

K = the system capacity

N = the calling population

D = the queuing discipline (e.g. FIFO)

Different scenarios were implemented in AnyLogic and the results of this are presented below.

#### Question 1: Assume that only one service register is installed. Calculate the average queuing time w of the customers using queuing theory.

By using formula (1) and the fixed values, we get:

(1) w = λ /( μ / (μ−λ))

λ = arrival rate = 12/60 min = 1/5 min

μ = service rate = 15/60 min = 1/4 min

w = average queuing time = (0.2)/((0.25)\*(0.25-0.2)) = 16 min

#### Question 2: Why should you always run multiple replications of a terminating simulation that uses stochastic data?

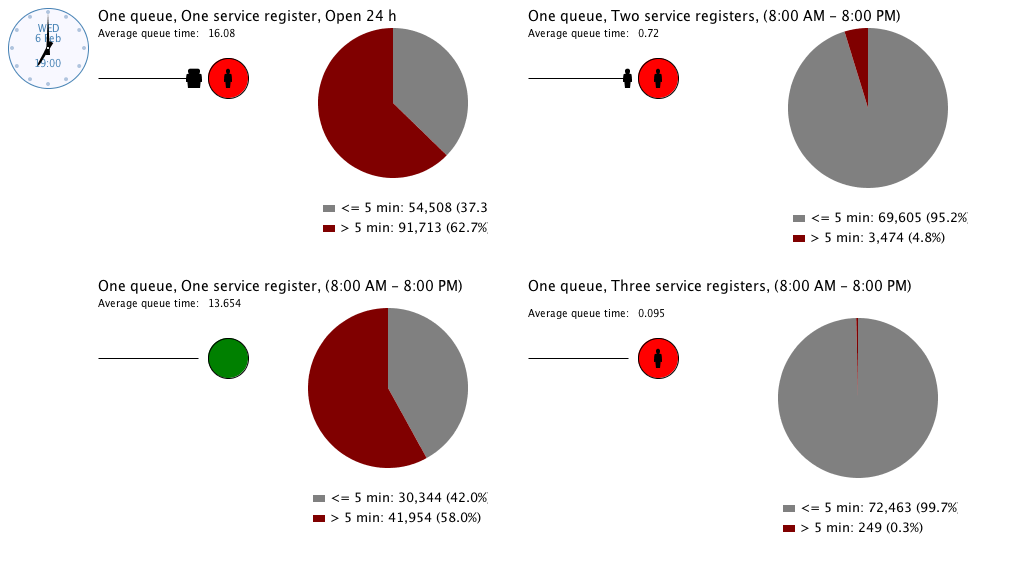
We ran multiple replications to get a more exact result, because each replicate can vary a lot.

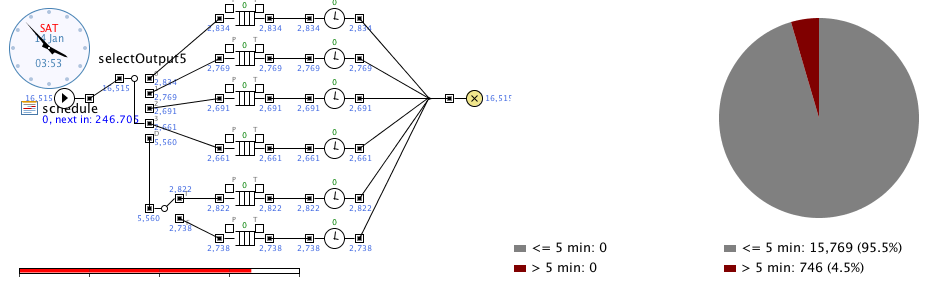
#### Question 3: Assume that only one service register is installed. What percentage of customers wait longer than five minutes?

60 % of the customers will wait longer than 5 minutes. See attached files (Pic 1).

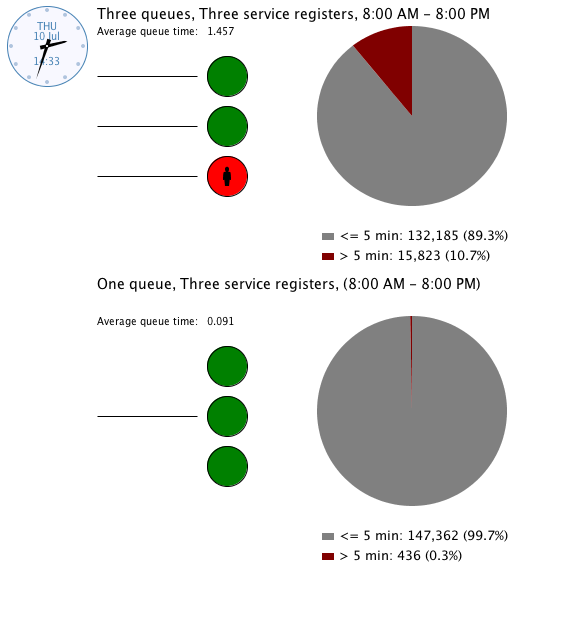
#### Question 4: How many service desks would be needed to guarantee that on average over 95% of the customers will wait less than 5 minutes for service; using a) an own queue for each service register and b) a shared queue for all service registers? Which queuing strategy would you recommend to CC?

a) 6 desks will give you that less than 5 %, see Pic 2.  
b) 2 desks gives you approx. 4.8 % - 5.0 % of the customers which is waiting over 5 min. (Pick 3 desks to be extremely sure that you’ll never get a percent over 5 %.  
I would recommend strategy b to CC, see Pic 3.



Pic. 1

Pic. 2



Pic 3.