BLEKINGE INSTITUTE OF TECHNOLOGY

Written test in (subject): ET2596 Simulation

Date: 2018.xx.xx

Name: _____

Civic number: _____

Number of sheets handed in:_____

Mark the question(s) you have answered by putting a ring around the relevant number(s)

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

Instructions
A student who cannot produce valid ID will not be permitted to take the examination.
No examination scripts will be accepted by the proctor during the first hour of the examination. (Students arriving late will thus be permitted to take part in the examination).
Write your name and civic number on each sheet of paper you hand in.
Examination results are posted by e-mail no later than 10 working days after the date of the examination. Exceptions to this rule can occur. In this case, students will be informed by the teacher responsible for the course/program or by the examiner.
All blank answer sheets are to be handed in to the proctor.

(To be filled in by the proctor)

ID presented: _____
Proctor's sign.

Student union fee paid: _____
Proctor's sign.

Student union fee not paid: _____
Proctor's sign.

(To be filled in by the teacher)

Number of credits gained:_____ Grade:_____ ECTS:_____Examiner´s sign:_____

(To be filled in and signed by the student, after the correction of the examination)

I hereby sign my examination script. I am aware that by signing for my script, after correction, I waive my right to contest the examiner's comments and the credits or grade awarded.

Date_____ Signature:_____

Sample-Exam In

Simulation
(2018.xx.xx) ET2596

Wednesday: XX:00 to XX;00

Lecturer: Siamak Khatibi

Allowed items on exam: Open book

The exam includes 5 problems (100 credit points); where for grade in ECTS you should obtain as following:

F (0-32), FX (33-49),
E (50-57), D (58-64),
C (65-74), B (75-82),
A (83-100)

Good Luck

PS: You can write your explanation texts on the paper or digitally however your Matlab or C codes should be delivered digitally.
Please do not forget to write which questions you have answered by checking under their numbers on examination folder.

Q1A

You can find the Q1A.slx in your material. Please run the Simulink code which is for queuing system. From the Simulink, you can see that the arrival rate is special which is resulting to special waiting and service time. Please comment/argue why our intention in simulation of the queuing system is wrong due to basic misunderstanding of simulation.

(8p)

Q1B

For a queuing system, we need to generate an arrival rate which has Poisson random characteristic. Generate such arrival events when their total number is 1000 with an average of 10 arrival per time unit. For those 1000 events calculate standard deviation, mean, maximum, and minimum vales of number of arrival per time unit.

Then choose 100 events of the 1000 events where any number of event (i.e. 1-1000 events) has the same probability to be chosen.

Finally find the distribution of 100 events which were chosen from the last part.

(12p)

Q2

We have two servers in a queuing system. Each server has a service processing with exponential characteristic. Server 1 and 2 have an average service time of 0.3 and 0.35 and producing a vector of random number X and Y respectively. We would like to generate a service random as Z=X+Y.

a) Show 1000 random number of Z. (7p)

b) Theoretically show the distribution of Z. (8p)

c) According your theoretical finding estimate the distribution of Z. (5p)

Q3

In simulation run, we discussed about warm-up in the lectures. We argued that without warm-up procedure the result will be non-stationary. Now we would like to simulate a non-stationary sequence of random numbers which has Gaussian characteristic.

You can simulate this sequence in many ways. Please show one of these ways.

(20p)

Q4

For a simulation, we need to generate random variate numbers (RVN). The cumulative distribution F is known and is according the following code:

```
x=0:(pi/100):pi/2;
F=sin(x); % an always growing curve
```

Generate 2000 random variate number and show the histogram of the numbers.

(20 p)

Q5

We would like to estimate $\theta = \int_0^1 e^x \, dx$ by simulation. The following code can be used for the estimation purpose.

```
N = 1000; %number of simulation points
U = rand(1,N); X = exp(U);
```

We can show some of statistical properties by

```
disp([mean(X) std(X) 2*std(X)/sqrt(N)])
```

Now use 2 methods of the variance reduction techniques (Common Random Numbers and Antithetic Variates) to reduce the variance of the estimation.

Hint: Use half of N to generate two new random numbers.