espol Facultad de Ciencias naturales y matemáticas

INGENIERÍA EN LOGÍSTICA Y TRANSPORTE

AÑO:	2022	**TÉRMINO:**	PRIMERO
MATERIA:	SIMULACIÓN MATEMÁTICA	**PROFESORES:**	DAVID DE SANTIS
EXAMEN:	SEGUNDO	**FECHA:**	02-09-2022

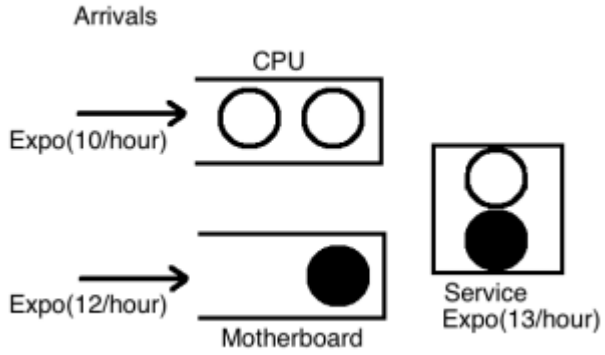
COMPROMISO DE HONOR

Yo declaro que he sido informado y conozco las normas disciplinarias que rigen a la ESPOL, en particular el Código de Ética y el Reglamento de Disciplina. Al aceptar este compromiso de honor, reconozco y estoy consciente de que la presente evaluación está diseñada para ser resuelta de forma individual; que puedo comunicarme únicamente con la persona responsable de la recepción de la evaluación; y que al realizar esta evaluación no navegaré en otras páginas que no sean las páginas de Aula Virtual/plataforma de la evaluación; que no recibiré ayuda ni presencial ni virtual; que no haré consultas en libros, notas, ni apuntes adicionales u otras fuentes indebidas o no autorizadas por el evaluador; ni usaré otros dispositivos electrónicos o de comunicación no autorizados. Además, me comprometo a mantener encendida la cámara durante todo el tiempo de ejecución de la evaluación, y en caso de que el profesor lo requiera, tomar una foto de las páginas en las que he escrito el desarrollo de los temas y subirla a Aula Virtual/plataforma de la evaluación, como evidencia del trabajo realizado, estando consciente que el no subirla, anulará mi evaluación. Acepto el presente compromiso, como constancia de haber leído y aceptado la declaración anterior y me comprometo a seguir fielmente las instrucciones que se indican para la realización de la presente evaluación (incluyendo los requisitos de uso de la tecnología). Estoy consciente que el incumplimiento del presente compromiso anulará automáticamente mi evaluación y podría ser objeto del inicio de un proceso disciplinario.

( ) Acepto ( ) No Acepto

Question1(25 points)

You has to simulate an assembly process which assembles two types of components: CPUs and motherboards (MB). The interarrival times of CPUs and motherboards to the assembly process are distributed exponentially with rates 10/hour and 12/hour respectively. There is only one machine in the assembly process which can assemble one CPU with one motherboard at a time and the assembly process takes an exponential time with rate 13/hour. When a component arrives it waits in the queue until the assembly machine is idle and there is a component of the other type.



The system starts empty and the arrival time of the first component of each type is distributed exponentially with the rates given above. You must do the simulation for 30 minutes in an excel spreadsheet using the uniform random variables given for it.

1. You must do 3 replications and for each of it you must draw the graphs:

a. Number of CPUs in the system vs time.
b. Number of Motherboard in the system vs time.

These graphs should be done in the exam paper.

2. You must construct a confidence interval for the number of assembled computers using the results obtained in the 3 replications. This can be done in an excel spreadsheet.
   If we desire to have a half-width of 0.1, how many replications should we run?

Question2(25 points)

A small manufacturing system produces three types of parts. There is a 30% chance of getting a Type 1 part, a 50% chance of getting a Type 2 part and a 20% chance of getting a Type 3 part. The parts arrive from an upstream process such that the time between arrivals is exponentially distributed with a mean of 6 minutes. All parts that enter the system must go through a preparation station. The preparation time is exponentially distributed with means 3, 5, and 7 minutes for part types 1, 2, and 3, respectively.

There is only space for 6 parts in the preparation queue. Any parts that that arrive to the system when there are 6 or more parts in the preparation leaves the system.

After preparation, the parts are processed on two different production lines. A production line is dedicated to type 1 parts and a production line is dedicated to type 2 and 3 parts. Each workstation has its own waiting area(queue).

The time to build a part type 2 or 3 part is triangularly distributed with a (min = 3, mode = 5, max = 7) minutes. Part type 1 is build following a normal distribution with a mean 12 minutes and a variance of 4.

Finally, the three parts are combined to create a final product. It is recommended to have 3 queues for each type of product before them are combined. The production time in this workstation follows a normal distribution with a mean 2 minutes and a variance of 9.

Implement the model in FlexSim, run it for 96 hours and collect the following statistics:

- The average, minimum and maximum staytime in all the queues(6).
- The state of all the workstations(processors and combiner).
- The total number of types parts that are processed and not processed(leave the system).
- The total number of final products that are made.

With this statistics indicate where are the neck bottles and propose solutions to improve them.(You don’t have to modify the model, only write on the paper the possible solutions)