CS421 - Computer Modeling and Simulation

Assignment 3

Due Date: 24th June, 2022

Task 1: Monte Carlo Simulation

For each of the given questions from 1 to 3, do parts a-d.

a. In the case of 2D problems, plot the function, f.
b. Using the Monte Carlo technique, define a function with a parameter for the number of darts that returns an estimate of the indicated value.
c. Define a function that calls the function from Part b 1000 times and returns the mean and standard deviation of the results.
d. Using any computational tool or programming language, calculate the answer with integration.

1. The area between the curve for $f(x) = \sqrt{(\cos^2(x) + 1)}$ and the x-axis from $x = 0$ to $x = 2$
2. The area between the curve for $f(x) = x^2$ and the x-axis from $x = 2$ to $x = 3$
3. An estimate of $\int_2^3 \sin(x^2)dx$. Note that the function is not entirely above or entirely below the x-axis, so we must adjust the algorithm studied in the class to estimate the integral. Recall that where a function is negative (below the x-axis), its integral is the negative of the area between the curve and the x-axis.

Task 2: Discrete Event Simulation of Queuing Model in AnyLogic

Make a simulation of a production line. The production line is pretty straight forward, 5 machines in line and all the products go through every machine. Three products are made and each product takes different time in different stages. Machines can take any amount of products so they can be easily represented with a delay.

The following table portrays the amount of time (in seconds) that each product takes to be processed in each machine.

Delays

	Machine 1	Machine 2	Machine 3	Machine 4	Machine 5
Product 1	170	25	20	40	120
Product 2	265	30	15	50	90
Product 3	380	40	10	25	100

Products enter the system in order. Every 5 seconds exactly 1 product will be generated. The first product to enter the system is product 1, followed by product 2, and followed by product 3. After product 3, product 1 enters again and so on (1-2-3-1-2-3-1-2-3… etc).

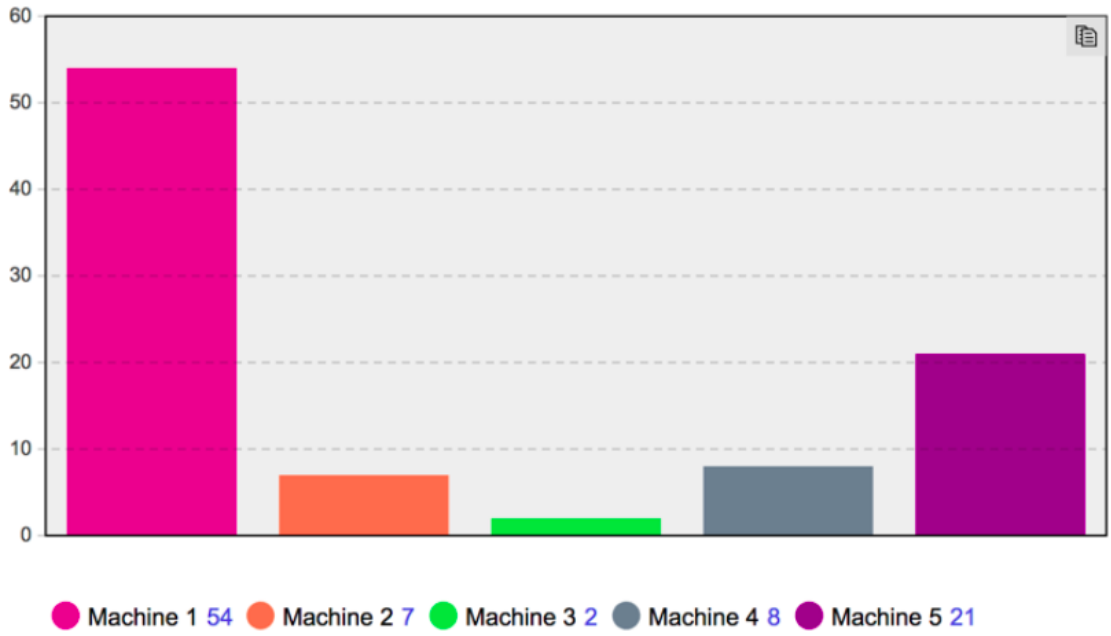
Consider the following assumptions:

- Machines do not need any setting time between different products.
- Delays are fixed.
- No queues at any point.

Generate an event that will occur only once after 1 hour with this action: ***finishSimulation();*** This will stop the simulation.

Generate a bar chart to discover the results. Each bar will show the amount of products in each machine. You can find the amount of products in a delay using ***delay.size();***

You will get the following result if you did it correctly:



Note: Make the model using Discrete events only. You are not allowed to use any agent populations, only agent types.

Task 3: Modeling Covid-19 in AnyLogic

Implement the Lipsitch Model for Covid-19 in AnyLogic tool. The values of parameters should be set based on some search on the Internet.