# Curtin University
## School of EECMS

### INDE3002
### Dynamic & Stochastic Modelling & Optimisation

### 2021 Assessment task: Simulation Project

*Please email your solution package to me (song.wang@curtin.edu.au) by 10am, Thursday, 28 October 2021. Your submission package should contain (a) the signed submission form and a rewritten report on how you solve the problems and what conclusions you make, and (b) your Matlab/Scilab source codes you used to produce the solutions to the problems.*

1. In a dice rolling game, each player repeatedly roll two unbiased dice (each having 6 faces with the numbers 1, 2,...,6 respectively) until the difference between the two numbers appeared is 4. Each roll will cost the player \$1 and the player cannot withdraw from playing. When the difference 4 appears, the player wins \$5 and the game ends.

   (a) Write a Matlab/Scilab program to simulate the game. (You may find my codes CoinFlip.m/CoinFlip.sce and Crap.m/Crap.sce useful.) Run the simulator 100,000 times and find the average win less loss (cost) of the player. (**10 marks**)

   (b) Use the result in part (a) to find whether the game is a fair game. If yes, explain why. Otherwise, how you can adjust the game payoff rule so that the resulting one is fair and use simulation results to support your claim that your new game design is fair. (Hint: By fairness we mean if the player plays the game repeatedly, the player is expected to break even.) (**10 marks**)

2. Consider the next-event inventory demand and order process with the order delay model, $tstart = 0$, $tstop = 100$ and the maximum inventory level $S = 100$. Suppose that the demand amount is a random variable which takes values from the set $\{0, 1, 2, 3\}$ with an equal probability for all (Uniform integer valued distribution). The demand arrival and order delay (or lag) processes are exactly the same as those in sis4.m/sis4.sce.

   (a) Assume that the unit costs for demand, setup, holding and shortage are respectively \$8000, \$1000, \$25 and \$700. Modify the Matlab/Scilab code sis4.m/sis4.sce to simulate the above inventory demand and order process and calculate the total (time) average cost when the minimum inventory level $s = 20$. (**10 marks**)

   (b) Use your program written in part (a) to calculate the average costs at the different sampling points of the minimum inventory level $s = 5, 10, 15, ..., 35, 40$, and use Monte-Carlo simulation with 100 runs to calculate the grand average total costs at the chosen minimum inventory levels. Graph the results from your Monte-Carlo simulation and estimate the value $s$ such that the average cost is minimized. (**10 marks**)

   (c) Although you set the maximum inventory level $S$ to 100 in parts (a) and (b), you have the flexibility to choose your maximum inventory level $S$. The modelling result shows that the unit holding cost is \$27 when $S < 90$, \$25 when $90 \leq S < 110$ and \$22 when $S \geq 110$. Similarly to part (b), by sampling $S$ uniformly within a range around $S = 100$ and keeping $s = 20$ fixed, calculate the total average cost for the samples of $S$ you have chosen, given that the other unit costs are the same as in part (a), and use Monte-Carlo simulation with 100 runs to find the grand average total costs at the sample points of $S$. Plot the total cost from your Monte-Carlo simulation against $S$ and estimate the optimal choice of $S$ which minimises the total cost. (**10 marks**)