

MACHAKOS UNIVERSITY
UNIVERSITY EXAMINATIONS

YEAR FOUR EXAMINATIONS FOR THE AWARD OF THE DEGREE OF BACHELOR OF
MATHEMATICS AND COMPUTER SCIENCE

SCO 303: SIMULATION AND MODELLING

STREAM: YEAR FOUR SEMESTER ONE

TIME: 2 HOURS

DAY/DATE:

INSTRUCTIONS

Answer question **ONE** and any other **TWO** questions

Marks are awarded for clear and concise answers

PART A: ANSWER ALL THE QUESTIONS

QUESTION ONE (30 MARKS)

- (a) Define the following terms:
- (i) Simulation
 - (ii) Modeling. (4 Marks)
- (b) Differentiate between the three different categories of simulation models. (6 Marks)
- (i) Discrete versus continuous.
 - (ii) Static versus dynamic.
 - (iii) Stochastic versus deterministic.
- (c) Give the three major queue behaviors. (3 Marks)
- (d) Explain four areas of application of simulation modeling. (4 Marks)
- (e) Explain the TWO important characteristics of random numbers. (4 Marks)
- (f) Describe THREE situations that may make a problem suitable for simulation modeling. (6 Marks)
- (g) Give THREE benefits of simulation modeling and analysis. (3 Marks)

QUESTION TWO (20 MARKS)

- (a) The table below shows a queuing problem:

A	B	C	D	E	F	G	H	I
Customers	Time Since Last	Arrival Time	Service Time	Time Service Begins	Time customer waits in	Time Service Ends	Time customer spends	Idle

	Arrival (Min)				the queue		in System	
1	-	0	4	0	0	4	4	0
2	8	8	1	8	0	9	1	4
3	6	14	4	14	0	18	4	5
4	1	15	3	18	3	21	6	0
5	8	23	2	23	0	25	2	2
6	3	26	4	26	0	30	4	1
7	8	34	5	34	0	39	5	4
8	7	41	4	41	0	45	4	2
9	2	43	5	45	2	50	7	0
10	3	46	3	50	4	53	7	0
11	1	47	3	53	6	56	9	0
12	1	48	5	56	8	61	13	0
13	5	53	4	61	8	65	12	0
14	6	59	1	65	6	66	7	0
15	3	62	5	66	4	71	9	0
16	8	70	4	71	1	75	5	0
17	1	71	3	75	4	78	7	0
18	2	73	3	78	5	81	8	0
19	4	77	2	81	4	83	6	0
20	5	82	3	83	1	86	4	0
Total			68		56		124	18

- (i) Calculate the average waiting time. (2 Marks)
- (ii) The probability that a customer will wait. (3 marks)
- (iii) The Probability of having an idle serve. (3 Marks)
- (iv) The average service time. (3 Marks)
- (v) The average time between arrivals. (3 Marks)
- (vi) The average waiting time for the customers who wait. (3 Marks)
- (vii) The average time spent by a customer in the system. (3 Marks)

QUESTION THREE (20 MARKS)

- (a) Using appropriate examples, explain the following terms as used in simulation and modeling.
- (i) System (2 Marks)
 - (ii) Entity (2 Marks)
 - (iii) Event (2 Marks)
 - (iv) Process (2 Marks)
- (b) Clearly describe all the steps in a simulation study. (12 Marks)

QUESTION FOUR (20 MARKS)

- (a) Describe five major pitfalls to avoid while conducting a simulation. (10 Marks)
- (b) Discuss the tests that can be performed on random numbers. (10 Marks)

QUESTION FIVE (20 MARKS)

- (a) Explain the role played by models in a simulation study. (10 Marks)
- (b) Discuss the different properties of a linear model. (10 Marks)