UNIVERSITY OF JOHANNESBURG

FACULTY:	Faculty of Engineering and Built Environment.
DEPARTMENT:	**QUALITY AND OPERATIONS MANAGEMENT**
CAMPUS:	DFC
MODULE:	OPT33B3/BPI33B3 OPERATIONS MANAGEMENT TECHNIQUES 3B
SEMESTER:	SECOND
EXAM:	Supplementary exam- January 2020

DATE: **08 January 2020** **SESSION:** **11:30-14:30**

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Ms. A.K LUMBWE

MODERATOR: PROF. O SAMUEL

DURATION: 3 Hours **MARKS:** 100

NUMBER OF PAGES: 7 PAGES

INSTRUCTIONS TO CANDIDATES:

- Answer ALL questions.
- This is a closed book assessment.
- Leave margins and spaces between the questions.
- Show **all** your calculations.
- Unless otherwise indicated, express your answers correct to **two (2) decimal** places.
- Where appropriate, indicate the units of your answer. (e.g. Hour, R)
- Number your answers clearly.
- Write neatly and legibly
- NOTE: Marks are awarded for theoretical knowledge, application of the theory and use of relevant examples.

The general University of Johannesburg policies, procedures and rules pertaining to written assessments apply to this assessment.

QUESTION 1 **[30]**

Due to the poor quality of various semiconductor products used in their manufacturing process, Micro Laboratory has decided to develop a QC program. Because the semiconductor parts they get from suppliers are either good or defective, Nkosi has decided to develop control charts for attributes. The total number of semiconductors in every sample is 200. Furthermore, Nkosi would like to determine the upper control chart limit and the lower control chart limit for various values of the fraction defective (p) in the sample taken. To allow more flexibility, he has decided to develop a table that lists values for p, UCL, and LCL. The values for p should range from 0.01 to 0.10, incrementing by 0.01 each time.

1.1. What are the Upper Control Limits and the Lower Control Limits for 99.7% confidence? (30)

QUESTION 2 **[15]**

A list of 15 issues, which have led to poor quality in the production of Bosch powerdrills are provided below. Create a fish-bone diagram using the 4M method.

A	Long Hours
B	No ISO certifications
C	No formalised training procedures
D	Inadequate tools Materials
E	get warm during production
F	No management focus
G	Not specialised equipment
H	High churn amongst employees
I	Random quality checks
J	Poor design of product
K	Insufficient capacity
L	Low educational level amongst employees
M	No documentation
N	Noisy production
O	Uneven quality in raw material

2.1. Create a fish-bone diagram and categorize each of these issues correctly, using the “four M s” (Material, Method, Machine, Man) method. (15)

QUESTION 3 **[40]**

Gauteng Appliance Center sells and services several brands of major appliances. Past sales for a particular model of refrigerator have resulted in the following probability distribution for demand:

Demand per week	Probability
0	0.20

1	0.40
2	0.20
3	0.15
4	0.05

The lead time, in weeks, is described by the following distribution:

Lead time (weeks)	Probability
1	0.15
2	0.35
3	0.50

Based on cost considerations as well as storage space, the company has decided to order 10 of these each time an order is placed. The holding cost is $1 per week for each unit that is left in inventory at the end of the week. The stockout cost has been set at $40 per stockout. The company has decided to place an order whenever there are only two refrigerators left at the end of the week.

3.1. Simulate 10 weeks of operation for Gauteng Appliance assuming there are currently 5 units in inventory.

Note:

Demand: Use the first column of the random number table starting with 52, 37...etc.

Lead-time: Use the second column of the random number table starting with 06, 63...etc

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SECTION B **[15]**

1. Simulation is a technique usually reserved for studying only the simplest and most straightforward of problems.

a. True
b. False

2. A simulation model is designed to arrive at a single specific numerical answer to a given problem.

a. True
b. False

3. Simulation typically requires a familiarity with statistics to evaluate the results.

a. True
b. False

4. The verification process involves making sure that

a. the model adequately represents the real-world system.
b. the model is internally consistent and logical.
c. the correct random numbers are used.
d. enough trial runs are simulated.

5. The validation process involves making sure that

a. the model adequately represents the real-world system.
b. the model is internally consistent and logical.
c. the correct random numbers are used.
d. enough trial runs are simulated.

6. Which of the following is an advantage of simulation?

a. It allows time compression.
b. It is always relatively simple and inexpensive.
c. The results are usually transferable to other problems.
d. It will always find the optimal solution to a problem.

7. Which of the following is a disadvantage of simulation?

a. It is inexpensive even for the most complex problem.
b. It always generates the optimal solution to a problem.
c. The results are usually transferable to other problems.
d. Managers must generate all of the conditions and constraints for solutions that they wish to examine.

8. A meteorologist was simulating the number of days that rain would occur in a month. The random number interval from 01 to 30 was used to indicate that rain occurred on a particular day, and the interval 31–00 indicated that rain did not occur. What is the probability that rain did occur?

a. 0.30
b. 0.31
c. 1.00
d. 0.70

9. Simulation is best thought of as a technique to

a. give concrete numerical answers.
b. increase understanding of a problem.
c. provide rapid solutions to relatively simple problems.
d. provide optimal solutions to complex problems.

10. When simulating the Monte Carlo experiment, the average simulated demand over the long run should approximate the

a. real demand.
b. expected demand.
c. sample demand.
d. daily demand.

11. The idea behind simulation is to

a. imitate a real-world situation.
b. study the properties and operating characteristics of a real-world situation.

c. draw conclusions and make action decisions based on simulation results.
d. all of the above.

12. Which of the following is/are property/properties of a dynamic programming problem?

a. Optimal substructure
b. Overlapping subproblems
c. Greedy approach
d. Both optimal substructure and overlapping subproblems

13. When dynamic programming is applied to a problem, it takes far less time as compared to other methods that don't take advantage of overlapping subproblems.

a. True
b. False

14. If a problem can be broken into subproblems which are reused several times, the problem possesses ____________ property.

a. Overlapping subproblems
b. Optimal substructure
c. Memorization
d. Greedy

15. Dynamic programming is a quantitative analytic technique applied to large, complex problems that have sequences of decisions to be made.

a. True
b. False

END OF EXAMINATION

TOTAL MARKS **[100]**

GOOD LUCK!

Annexures

Upper control limit (UCL) $= \bar{\bar{x}} + z\sigma_{\bar{x}}$
Upper limit for an $\bar{x}$-chart using standard deviations.

Lower control limit (UCL) $= \bar{\bar{x}} - z\sigma_{\bar{x}}$
Lower control limit for an $\bar{x}$-chart using standard deviations.

$UCL_{\bar{x}} = \bar{\bar{x}} + A_2\bar{R}$
Upper control limit for an $\bar{x}$-chart using tabled values and ranges.

$LCL_{\bar{x}} = \bar{\bar{x}} - A_2\bar{R}$
Lower control limit for an $\bar{x}$-chart using tabled values and ranges.

$UCL_R = D_4\bar{R}$
Upper control limit for a range chart.

$LCL_R = D_3\bar{R}$
Lower control limit for a range chart.

$UCL_p = \bar{p} + z\sigma_p$
Upper control unit for a p-chart.

$LCL_p = \bar{p} - z\sigma_p$
Lower control limit for a p-chart.

$$\hat{\sigma}_p = \sqrt{\frac{\bar{p}(1-\bar{p})}{n}}$$
Estimated standard deviation of a binomial distribution.

$\bar{c} \pm 3\sqrt{\bar{c}}$
Upper and lower limits for a c-chart.

52	06	50	88	53	30	10	47	99	37	66	91	35	32	00	84	57	07
37	63	28	02	74	35	24	03	29	60	74	85	90	73	59	55	17	60
82	57	68	28	05	94	03	11	27	79	90	87	92	41	09	25	36	77
69	02	36	49	71	99	32	10	75	21	95	90	94	38	97	71	72	49
98	94	90	36	06	78	23	67	89	85	29	21	25	73	69	34	85	76
96	52	62	87	49	56	59	23	78	71	72	90	57	01	98	57	31	95
33	69	27	21	11	60	95	89	68	48	17	89	34	09	93	50	44	51
50	33	50	95	13	44	34	62	64	39	55	29	30	64	49	44	30	16
88	32	18	50	62	57	34	56	62	31	15	40	90	34	51	95	26	14
90	30	36	24	69	82	51	74	30	35	36	85	01	55	92	64	09	85
50	48	61	18	85	23	08	54	17	12	80	69	24	84	92	16	49	59
27	88	21	62	69	64	48	31	12	73	02	68	00	16	16	46	13	85
45	14	46	32	13	49	66	62	74	41	86	98	92	98	84	54	33	40
81	02	01	78	82	74	97	37	45	31	94	99	42	49	27	64	89	42
66	83	14	74	27	76	03	33	11	97	59	81	72	00	64	61	13	52
74	05	81	82	93	09	96	33	52	78	13	06	28	30	94	23	37	39
30	34	87	01	74	11	46	82	59	94	25	34	32	23	17	01	58	73
59	55	72	33	62	13	74	68	22	44	42	09	32	46	71	79	45	89
67	09	80	98	99	25	77	50	03	32	36	63	65	75	94	19	95	88
60	77	46	63	71	69	44	22	03	85	14	48	69	13	30	50	33	24
60	08	19	29	36	72	30	27	50	64	85	72	75	29	87	05	75	01
80	45	86	99	02	34	87	08	86	84	49	76	24	08	01	86	29	11
53	84	49	63	26	65	72	84	85	63	26	02	75	26	92	62	40	67
69	84	12	94	51	36	17	02	15	29	16	52	56	43	26	22	08	62
37	77	13	10	02	18	31	19	32	85	31	94	81	43	31	58	33	51

Factors for Computing Control Chart Limits

SAMPLE SIZE, n	MEAN FACTOR, A_2	UPPER RANGE, D_4	LOWER RANGE, D_3
2	1.880	3.268	0
3	1.023	2.574	0
4	0.729	2.282	0
5	0.577	2.114	0
6	0.483	2.004	0
7	0.419	1.924	0.076
8	0.373	1.864	0.136
9	0.337	1.816	0.184
10	0.308	1.777	0.223
12	0.266	1.716	0.284
14	0.235	1.671	0.329
16	0.212	1.636	0.364
18	0.194	1.608	0.392
20	0.180	1.586	0.414
25	0.153	1.541	0.459