UNIVERSITY OF JOHANNESBURG

FACULTY OF ENGINEERING AND BUILT ENVIRONMENT

NOVEMBER 2016 EXAMINATION

DEPARTMENT		**QUALITY AND OPERATIONS MANAGEMENT**
PROGRAMME	:	**NATIONAL DIPLOMA OPERATIONS MANAGEMENT**
SUBJECT	:	**OPERATIONS MANAGEMENT TECHNIQUES III**
CODE	:	**BPI33B3**
DATE	:	**24 NOVEMBER 2016**
DURATION	:	**3 HOUR (8:30H – 11:30H)**
TOTAL MARKS	:	**100** **WEIGHT** : **50**

EXAMINER(S)	:	**MS E NWOBODO-ANYADIEGWU**
MODERATOR(EXTERNAL):		**PROF OM SAMUEL**
NUMBER OF PAGES	:	**12 PAGES**
REQUIREMENT	:	GRAPH PAPPER, CALCULATOR, SCANNER SHEET

INSTRUCTIONS TO CANDIDATES:

- Answer ALL questions.
- This is a closed book assessment.
- Question paper **must be handed in.**
- Leave margins and spaces between the questions.
- Show all your calculations.
- Unless otherwise indicated, express your answers correct to four (4) decimal places.
- Where appropriate, indicate the units of your answer. (e.g. Hour, R)
- Number your answers clearly.
- NOTE: Marks will be 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.

SECTION A [75]

Question 1 Simulation [25]

Dr. Mark Kussel is a peadiatrician at the Parklane clinic. Kussel tries hard to schedule appointment so that patients do not have to wait beyond their appointment time. His December 2 schedule is shown in the following table.

Scheduled Appointment And Time		Expected Time Needed
Adams	9:30 a.m.	15
Belinda	9:45 a.m.	20
Charles	10:15 a.m.	15
Desmond	10:30a.m.	10
Eveth	10:45 a.m.	30
Francis	11:15 a.m.	15
Graham	11:30 a.m.	20
Helen	11:45 a.m.	15

Unfortunately, not every patient arrives exactly on schedule, and expected times to examine patients are just that – *expected.* Some examinations take longer than expected, and some take less time.

Kussel's experience dictates the following:

- 20% of the patients will be 20 minutes early.
- 10% of the patients will be 10 minutes early.
- 40% of the patients will be on time.
- 25% of the patients will be 10 minutes late.
- 5% of the patients will be 20 minutes late.

He further estimates that:

a. 15% of the time he will finish in 20% less time than expected.

b. 50% of the time he will finish in the expected time.

c. 25% of the time he will finish in 20% more time than expected.

d. 10% of the time he will finish in 40% more time than expected.

Dr. Kussel has to leave 12:30 p.m. on December 2 to catch a flight to a national conference for peadiatricians in Capetown.

Assuming that he is already to start his workday at 9:30 a.m. and that patients are treated in order of their schedule exam (even if one late patient arrives after an early one), will he be able to make the flight? Comment on this simulation.

NOTE: From table of Random numbers (Annexure 3): starting from the bottom select Row 5 (beginning with 60, 80...) to get the random numbers for Arrival time, and use Row 4 from the bottom (starting with 80, 45.) for the Examination length.

Question 2 **[25]**

Daily samples of 100 power drills are removed from Drill Master's assembly line and inspected for defects. Over the past 21 days, the following information has been gathered. Develop a 3 standard deviation (99.7% confidence) p-chart.

2.1 Calculate (1) the overall fraction of errors (p) and (2) the upper and lower control limits on a control chart (6)

2.2 Plot (1) the overall fraction of errors (p), (2) the upper and lower control limits and (4)the fraction of errors in each sample on a control chart . (10)

Note: Use the Graph paper provided.

2.3 Is the process in control? justify your answer; and determine if corrective action is needed. Also recommend the next line of action. (4)

Day	Number Defective	Day	Number Defective	Day	Number Defective
1	6	8	3	15	4
2	5	9	6	16	5
3	6	10	3	17	6
4	4	11	7	18	5
5	3	12	5	19	4
6	4	13	4	20	3
7	5	14	3	21	7

2.4 What is the difference between implementing house of quality for service offering compared to house of quality for manufactured product? (5)

QUESTION 3 **[25]**

3.1 You have just come from a cousin's wedding reception. It didn't turn out as well as it should have, and the bride's parents are pretty mad at how things turned out. The following complaints has been generally identified

A- The food was cold because the warming mechanism was not efficient.
B- The activities were not on time according to the schedule.
C- The waiters were not properly attired.
D- There were not enough plates, glassware and utensils.
E- The reception venue was too hot as air conditioners was broken
F- The changing room was dirty.
G- The rooms were too small.
H- Furniture poorly arranged;
I- Ran out of food;
J- Wait staff not speedy
K- Prepared wrong dish
L- Wait staff not courteous.
M- The food was "bad'.
N- The couple were over charged.
O- Poor sound system

Use the supplied template ie **A - O** acronym to construct a conventional cause-and-effect diagram. On the basis the 4*Ms* Categorise the sources of defects for the issue "dissatisfied customer of wedding reception caterer." (20)

3.2 What is the major limitation of the Ishikawa diagram and how can this limitation be mitigated? (5)

SECTION B Use the scanner sheet **[25]**
Choose the correct option:

The following information is for Question 1- 5

A Quality Analyst wants to construct a control chart for determining whether three machines, all producing the same product, are under control with regard to a particular quality variable. Accordingly, he sampled four units of output from each machine, with the following results:

Machine		Measurements			
#1		17	15	15	17
#2		16	25	18	25
#3		23	24	23	22

1. What is the sample mean for machine #1?

A) 15

B) 16

C) 17

D) 21

E) 23

2. What is the estimate of the process mean for whenever it is under control?

A) 16

B) 19

C) 20

D) 21

E) 23

3. What is the estimate of the sample average range based upon this limited sample?

A) 13.0

B) 4.33

C) 5.4

D) 4.2

E) 2.0

4. What are the x-bar chart three sigma upper and lower control limits?

A) 22 and 18

B) 23.29 and 16.71

C) 23.5 and 16.5

D) 23.16 and 16.84

E) 24 and 16

5. For upper and lower control limits of 23.29 and 16.71, which machine(s), if any, appear(s) to have an out-of-control process mean?

A) machine #1

B) machine #2

C) machine #3

D) all of the machines

E) none of the machines

Refer to the following information to answer questions 6 - 8

The Chair of the Operations Management Department at University of Johannesburg wants to construct a p-chart for determining whether the five departments offering the basic P/OM course are under control with regard to the number of students who fail the course. Accordingly, he sampled 100 final grades from last year for each instructor, with the following results:

INSTRUCTOR	NUMBER OF FAILURES
Prof. A	13
Prof. B	0
Prof. C	11
Prof. D	16

6. What is the sample proportion of failures (p) for Prof. D?

A) 0

B) .04

C) .11

D) .13

E) .16

7. What is the estimate of the mean proportion of failures for these instructors?

A) .10

B) .11

C) .13

D) .16

E) .40

8. What is the estimate of the standard deviation of the sampling distribution for an instructor's sample proportion of failures?

A) .0075

B) .03

C) .075

D) .3

E) .75

9. If we wish to monitor the average diameter of the hula hoops we are producing, the distribution we base our statistics on is the _____ distribution.

A) normal

B) poisson

C) binomial

D) exponential

10. A(n) _____ chart is appropriate to monitor the number of needle sticks incurred inadvertently by nurses who are administering medications.

A) X

B) R

C) C

D) P

E) none of the above

11. A(n) _____ chart is appropriate to monitor the percent of mortalities due to heart problems.

A) X

B) R

C) P

D) C

E) none of the above

12. A company has been receiving complaints about the attitude of some sales clerks. Over a 10-day period, the total number of complaints was 360. The company wishes to develop a control chart for the number of complaints. What would the upper control limit on the number of complaints per day be for a 3 sigma (99.7%) control chart?

A) 18

B) 36

C) 42

D) 54

E) none of the above

13. A company has been receiving complaints about the attitude of some sales clerks. Over a 10-day period, the total number of complaints was 250. The company wishes to develop a control chart for the number of complaints. What would the lower control limit on the number of complaints per day be for a 3 sigma (99.7%) control chart?

(A) 20

(B) 0

(C) 15

(D) 10

(E) 202.6

14. A manager wants to build 3σ control limits for a process. The target value for the mean of the process is 10 units, and the standard deviation of the process is 6. If samples of size 9 are to be taken, the UCL and LCL will be

A) -8 and 28

B) 16 and 4

C) 12 and 8

D) 4 and 16

E) 8 and 12

15. The type of inspection that classifies items as being either good or defective is

A) variable inspection

B) attribute inspection

C) fixed inspection

D) all of the above

E) none of the above

For question 16 – 25 answer True or False.

On the scanner sheet shed option ***A*** for true and ***B*** for false.

16. Simulation provides optimal solutions to problems.
17. Like mathematical and analytical models, simulation is restricted to using the standard probability distributions.
18. Simulation models are inexpensive to design and use.
19. Simulation models, because they are based on the generation of random numbers, fail to give the same solution in repeated use to any particular problem.
20. By starting random number intervals at 01, not 00, the top of each range is the cumulative probability.
21. A simulation model is designed to arrive at a single specific numerical answer to a given problem.
22. A simulation is "Monte Carlo" when the elements of a system being simulated exhibit chance in their behavior.
23. Random number intervals are based on cumulative probability distributions.
24. Results of simulation experiments with large numbers of trials or long experimental runs will generally be better than those with fewer trials or shorter experimental runs.
25. Some reasons for the use of simulation in queuing are that the four standard queuing models do not allow for LIFO (or LIFS) discipline, for multi-phase waiting lines, or for unusual arrival and service distributions.

TOTAL MARKS **[100]**

END OF ASSESSMENT

Annexure 1: **Formula Sheet**

$$UCLx = \bar{\bar{X}} + A_2 * \bar{R} \qquad UCLx = \bar{\bar{X}} - A_2 * \bar{R}$$

$$UCLR = D4 * \bar{R} \quad \text{and} \quad LCL_R = D3 * \bar{R}$$

$$UCL_P = \bar{p} + Z\sqrt{\frac{\bar{p}(1-\bar{p})}{n}} \qquad LCL_P = \bar{p} - Z\sqrt{\frac{\bar{p}(1-\bar{p})}{n}}$$

$$UCL_{\bar{x}} = \bar{\bar{x}} + z\left(\frac{\sigma_x}{\sqrt{n}}\right) \qquad LCL_{\bar{x}} = \bar{\bar{x}} - z\left(\frac{\sigma_x}{\sqrt{n}}\right)$$

ANNEXURE 2

Sample size, n Mean FactorA_2 UPPER RANGE D_4 LOWER RANGE D_3

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

ANNEXURE 3 Table of Random numbers

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

ANNEXURE 4