UNIVERSITY OF JOHANNESBURG

FACULTY OF ENGINEERING AND BUILT ENVIRONMENT

NOVEMBER 2015 EXAMINATION

DEPARTMENT QUALITY AND OPERATIONS MANAGEMENT

PROGRAMME : NATIONAL DIPLOMA OPERATIONS MANAGEMENT

SUBJECT : OPERATIONS MANAGEMENT TECHNIQUES III

CODE : BPI33B3

DATE : SUMMER EXAMINATION 2015
14 NOVEMBER 2015

DURATION : (SESSION 2) 12:30 - 16:30

TOTAL MARKS : 100 **WEIGHT** : 50

EXAMINER(S) : MS E NWOBODO-ANYADIEGWU

MODERATOR(EXTERNAL): MR S FORE

NUMBER OF PAGES : 11 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 CASE STUDY: Johannesburg Daily Star **[25]**

In May 2015 the Johannesburg Daily Star published its first newspaper in direct competition with two other newspapers, the Citizen and the Sunday Times, a weekly publication. Presently the Citizen is the most widely read newspaper in the area, with a total circulation of 99500.The Daily Star, however, has made significant inroads into the readership market since its inception. Total circulation of the Star now exceeds 85000.

Dumi Mabaso, editor of the Star, attributes the success of the newspaper to the accuracy of its contents, a strong editorial section, and the proper blending of local, regional, national and international news items. In addition, the paper has been successful in getting the accounts of several major retailers who advertises extensively in the display section. Finally, experienced reporters photographers ,copy writers ,typesetters ,editors and other personnel have formed a team dedicated to providing the most timely and accurate reporting of news in the area.

Of critical importance to good –quality newspaper printing is accurate typesetting .To assure quality in the final print, Ms.Letsoko has decided to develop a procedure for monitoring the performance of typesetters over a period of time. Such a procedure involves sampling output, establishing control limits, comparing the Star's accuracy with that of the industry, and occasionally updating the information.

First, Ms. Letsoko randomly selected **30** newspapers published during the preceding 12months .From each paper ,100 paragraphs were randomly chosen and were read for accuracy .The number of paragraphs with errors in each paper was recorded , and the fraction of paragraphs with errors in each sample was determined .The table below shows the results of the sampling.

Sample	Paragraphs with errors in the sample	Fraction of paragraphs with errors (per 100)	Samples	Paragraphs with errors in the sample	Fraction of paragraphs with errors (per 100)
1	2	0.02	16	2	0.02
2	4	0.04	17	3	0.03
3	10	0.10	18	7	0.07
4	4	0.04	19	3	0.03
5	1	0.01	20	2	0.02
6	1	0.01	21	3	0.03
7	13	0.13	22	7	0.07
8	9	0.09	23	4	0.04
9	11	0.11	24	3	0.03
10	0	0.00	25	2	0.02
11	3	0.03	26	2	0.02
12	4	0.04	27	0	0.00
13	2	0.02	28	1	0.01
14	2	0.02	29	3	0.03
15	8	0.08	30	4	0.04

Questions

1. Calculate the overall fraction of errors (p) and the upper and lower control limits on a control chart using a 95.45% confidence level. (9)

2. Assume that the industry upper and lower control limits are 0.100 and 0.040, respectively. Plot them on the control chart. (2)

3. Plot the fraction of errors in each sample, the overall fraction of errors (p)and the upper and lower control limits on the control chart (7)

   Note: Use the Graph paper provided.

4. Do all fall within the firms control limits? Justify your answer. If anyone falls outside the control limits, what should be done? (7)

QUESTION 2 – Dynamic Programming [10]

The data below details the distances that a delivery service must travel.

2.1 Draw the network diagram showing the optimal solution for each node(city)(7)

2.2 What is the shortest route (minimum distance) from City 1 to City 8; and how long is the distance? (3)

From	To	Distance (miles)
1	2	18
1	3	14
1	4	16
2	5	9
2	6	8
3	5	7
3	6	6

From	To	Distance (miles)
4	5	8
4	6	6
4	7	5
5	8	17
6	8	16
7	8	20

Question 3 - Simulation [40]

3.1 Henry has a newspaper stand where he sells papers for R0.50 each. The papers cost him R0.30 each, giving him a 20-cent profit on each one he sells. From past experience, Henry knows that

20% of the time he sells 100 papers
20% of the time he sells 150 papers
30% of the time he sells 200 papers

30% of the time he sells 250 papers

Assuming that Henry believes the cost of a lost sale is 10 cents and any unsold papers cost him R0.30.

3.1.1 Simulate Henry's profit outlook over 10 days if he orders 175 papers for each of the 10 days. Use the following random numbers: 52, 06, 50, 88, 53, 30, 10, 47, 99, 37. Tabulate your answer to show - daily demand; quantity unsold; lost sales and profit for each of the 10 days of simulation. (25)

3.1.2 Henry recently got an offer to work for the Newspaper Company for a wage of R35 per day. Based on his average daily income (profit) from the simulation Do you think he should take the offer or not? (5)

3.2 Every simulation process involves a series of steps, use a well annotated flow diagram to enumerate these step and the link between the various steps where applicable. (10)

SECTION B Use the scanner sheet **[25]**

Choose the correct option:

A Quality Analyst wants to construct a sample mean chart for controlling a packaging process. He knows from past experience that whenever this process is under control, package weight is normally distributed with a mean of twenty ounces and a standard deviation of two ounces. Each day last week, he randomly selected four packages and weighed each:

Day	WEIGHT (ounces)			
Monday	23	22	23	24
Tuesday	23	21	19	21
Wednesday	20	19	20	21
Thursday	18	19	20	19
Friday	18	20	22	20

1. What is the sample mean package weight for Tuesday?

a) 19 ounces

b) 21 ounces

c) 20.6 ounces

d) 21.2 ounces

e) 23 ounces

2. What is the sample mean package weight for Thursday?

a) 19 ounces

b) 20 ounces

c) 20.6 ounces

d) 21 ounces

e) 23 ounces

3. What is the mean of the sampling distribution of sample means for whenever this process is under control?

a) 18 ounces

b) 19 ounces

c) 20 ounces

d) 21 ounces

e) 22 ounces

4. What is the average range for this process?

a) 2.1 ounces

b) 2.4 ounces

c) 2.6 ounces

d) 2.8 ounces

e) 3.0 ounces

5. What is the upper control limits for R chart?

a) 3.69 ounces

b) 6.39 ounces

c) 9.36 ounces

d) 3.86 ounces

e) 9.63 ounces

6. What is the lower control limits for R chart?

a) 0 ounces

b. 0.2 ounces

c. 0.1 ounces

d. 0.01 ounces

e. 1.0 ounces

7. If he uses upper and lower control limits of 22 and 18 ounces, on what day(s), if any, does this process appear to be out of control?

a. Monday

b. Tuesday

c. Monday and Tuesday

d. Monday, Tuesday, and Thursday

8. If $\bar{\bar{x}}$ = 23 ounces, σ = 0.4 ounces, and n = 16, the $\pm 3\sigma$ the lower control limits will be

   a. 24.2 ounces

   b. 23 ounces

   c. 22.7 ounces

   d. 23.75 ounces

   e. none of the above

9. If $\bar{\bar{x}}$ = 23 ounces, σ = 0.4 ounces, and n = 16, the $\pm 3\sigma$ the upper control limits will be

   a. 21.8 ounces

   b. 23.2 ounces

   c. 22.70 ounces

   d. 23.3 ounces

   e. none of the above

10. A quality loss function includes all of the following costs **except**

    a. the cost of scrap and repair

    b. the cost of customer dissatisfaction

    c. inspection, warranty, and service costs

    d. sales costs

    e. costs to society

11. Pareto charts are used to
    a. identify inspection points in a process
    b. outline production schedules
    c. organize errors, problems, or defects
    d. show material flow
    e. all of the above
12. The "four Ms" of cause-and-effect diagrams are
    a. material, machinery/equipment, manpower, and methods
    b. material, methods, men, and mental attitude
    c. named after four quality experts
    d. material, management, manpower, and motivation
    e. none of the above.
13. Among the tools, the tool ordinarily used to aid in understanding the sequence of events through which a product travels is a
    a. Pareto chart
    b. process chart
    c. check sheet
    d. Taguchi map
    e. poka-yoke
14. The process improvement technique that sorts the "vital few" from the "trivial many" is
    a. Taguchi analysis
    b. Pareto analysis
    c. benchmarking
    d. Deming analysis
    e. Yamaguchi analysis

15. A production manager at a pottery factory has noticed that about 70 percent of defects result from impurities in raw materials, 15 percent result from human error, 10 percent from machine malfunctions, and 5 percent from a variety of other causes. This manager is most likely using

a. a Pareto chart

b. a scatter diagram

c. a Taguchi loss function

d. a cause and effect diagram

e. a flow chart

16. Stakeholders who are affected by the production and marketing of poor quality products include

a. stockholders, employees, and customers

b. suppliers and creditors, but not distributors

c. only stockholders, creditors, and owners

d. suppliers and distributors, but not customers

e. only stockholders and organizational executives and managers

17. A customer service manager at a retail clothing store has collected numerous customer complaints from the forms they fill out on merchandise returns. To analyze trends or patterns in these returns, she has organized these complaints into a small number of categories. This is most closely related to the _____ tool of TQM.

a. Taguchi loss function

b. cause and effect diagram

c. scatter diagram

d. histogram

e. process control chart

18. A manager tells her production employees, "It's no longer good enough that your work fall anywhere within the specification limits. I need your work to be as close to the target value as possible." Her thinking is reflective of

a. internal benchmarking

b. Six Sigma

c. ISO 9000

d. Taguchi concepts

e. process control charts

19. If a sample of parts is measured and the mean of the measurements is outside the control limits, the process is

a. in control, but not capable of producing within the established control limits.

b. out of control and the process should be investigated for assignable variation.

c. within the established control limits with only natural causes of variation.

d. monitored closely to see if the next sample mean will also fall outside the control limits.

e. none of the above.

20. A quality circle holds a brainstorming session and attempts to identify the factors responsible for flaws in a product. Which tool do you suggest they use to organize their findings?

    a. Ishikawa diagram

    b. Pareto chart

    c. process chart

    d. control charts

    e. activity chart

21. Which of the following is **false** regarding control charts?

a. Values above the upper control limits always imply that the product's quality is exceeding expectations.

b. Control charts are built so that new data can be quickly compared to past performance data.

c. Control charts graphically present data.

d. Control charts plot data over time.

e. None of the above is false.

22. A recent consumer survey conducted for a car dealership indicates that, when buying a car, customers are primarily concerned with the salesperson's ability to explain the car's features, the salesperson's friendliness, and the dealer's honesty. The dealership should be **especially** concerned with which determinants of service quality?

    a. communication, courtesy, and credibility

    b. competence, courtesy, and security

    c. competence, responsiveness, and reliability

    d. communication, responsiveness, and reliability

    e. understanding/knowing customer, responsiveness, and reliability

23. Marketing issues such as advertising, image, and promotion are important to quality because

    a. they define for consumers the tangible elements of a service

    b. the intangible attributes of a product (including any accompanying service) may not be defined by the consumer

    c. they educate consumers on how to use the product

    d. they make the product seem more valuable than it really is

    e. they raise expenses and therefore decrease profitability

24. Which of the determinants of service quality involves having the customer's best interests at heart?

    a. access

    b. courtesy

    c. credibility

    d. responsiveness

    e. tangibles

25. Which of the determinants of service quality involves performing the service right the first time?

    a. access

    b. courtesy

    c. credibility

    d. reliability

    e. responsiveness

TOTAL MARKS **[100]**

END OF ASSESSMENT

Annexure 1: **Formula Sheet**

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

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

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

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

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

MEMORANDUM

SECTION A: CASE STUDY