



**UNIVERSITI TUN HUSSEIN ONN
MALAYSIA**

**FINAL EXAMINATION
SEMESTER II
SESSION 2009/2010**

SUBJECT NAME : TOTAL QUALITY
MANAGEMENT

SUBJECT CODE : BPB 2083

COURSE : 2 BPA / 2 BPB

EXAMINATION DATE : APRIL / MAY 2010

DURATION : 2 HOURS 30 MINUTES

INSTRUCTION : PART A
ANSWER **ALL** QUESTIONS

PART B
ANSWER **TWO (2)**
QUESTIONS ONLY OUT OF
FOUR (4) QUESTIONS

THIS QUESTION PAPER CONSISTS OF 7 PAGES

PART A (50 marks)

Q1 As a quality officer at HIJ Fertilizer Sdn. Bhd., you have collected filling process data for bags of nitrogen fertilizer in your factory to determine the state of its quality control. The data were collected in subgroup sizes of 6. Table Q1 shows the average and range of the fertilizer bags in kilogram.

Table Q1: Average and range of fertilizer bags (kilogram)

| Sample | x-bar | R | Sample | x-bar | R |
|--------|-------|------|--------|-------|------|
| 1 | 20.35 | 0.34 | 14 | 20.41 | 0.36 |
| 2 | 20.40 | 0.36 | 15 | 20.45 | 0.34 |
| 3 | 20.36 | 0.32 | 16 | 20.34 | 0.36 |
| 4 | 20.65 | 0.36 | 17 | 20.36 | 0.37 |
| 5 | 20.20 | 0.36 | 18 | 20.42 | 0.73 |
| 6 | 20.40 | 0.35 | 19 | 20.50 | 0.38 |
| 7 | 20.43 | 0.31 | 20 | 20.31 | 0.35 |
| 8 | 20.37 | 0.34 | 21 | 20.39 | 0.38 |
| 9 | 20.48 | 0.30 | 22 | 20.39 | 0.33 |
| 10 | 20.42 | 0.37 | 23 | 20.40 | 0.32 |
| 11 | 20.39 | 0.29 | 24 | 20.41 | 0.34 |
| 12 | 20.38 | 0.30 | 25 | 20.40 | 0.30 |
| 13 | 20.40 | 0.33 | | | |

* Note: Round all calculations to two decimal points

- (a) Calculate the trial central line and control limits. (7 marks)
- (b) Calculate revised central line and control limits with the assumption that causes of defects are assignable if any points in Q1(a) are out of control. (8 marks)
- (c) Develop the revised \bar{x} -bar and R charts. (5 marks)
- (d) Evaluate the state of quality control in filling bags of fertilizers in Q1(a) and Q1(b) by referring to the points which are outside of the control limits. (5 marks)

Q2 Global competition and economic liberalization are creating opportunities for Malaysian organizations. They use quality to compete with other organizations to improve their market share. Total Quality Management (TQM) is one of the important quality techniques which many firms are using to succeed. In addition, it has been widely implemented throughout the world across different industries and sectors.

The implementation of TQM has given positive result but some organizations find it difficult to implement it in a satisfactory and efficient way. They also noticed some barriers or obstacles which hinder the implementation of TQM.

Discuss **SIX (6)** barriers to TQM implementation that prevent organizations from achieving the benefits expected from it.

(25 marks)

PART B (50 marks)

- Q3 The variation concept is the law of nature in that no two natural items in any categories are the same. Variation is present in every manufacturing process due to a combination of equipment, materials, environment, and operator.

Discuss **FOUR (4)** sources of variation in manufacturing process with an example for each source.

(25 marks)

- Q4 Sunway Lagoon Sdn. Bhd. wants to maintain the pH value for swimming pool water of its theme park. One reading is taken each day for 20 days as shown in Table Q4.

Table Q4: pH value of swimming pool water

| Sampel | pH | Sampel | pH |
|--------|------|--------|------|
| 1 | 4.56 | 11 | 4.58 |
| 2 | 4.65 | 12 | 4.71 |
| 3 | 4.66 | 13 | 4.61 |
| 4 | 4.34 | 14 | 4.66 |
| 5 | 4.65 | 15 | 4.46 |
| 6 | 4.40 | 16 | 4.70 |
| 7 | 4.50 | 17 | 4.65 |
| 8 | 4.55 | 18 | 4.61 |
| 9 | 4.69 | 19 | 4.54 |
| 10 | 4.29 | 20 | 4.55 |

*Note: Round all calculations to three decimal points.

- (a) Calculate the central line and control limits using moving average and moving range method with $n = 3$.
(10 marks)
- (b) Calculate the central line and control limits for a period of 4 using the same method in Q4(a).
(10 marks)
- (c) Explain the differences between the trial central line and control limits of the water pH value in Q4(a) and Q4(b).
(5 marks)

- Q5 A p chart is used in quality control to report the fraction or percent of nonconforming in a product, quality characteristic, or group of quality characteristics. Table Q5 shows the data for the payment of insurance claims.

Table Q5: Number of conformance of insurance claims payment

| Sampel | Number of Inspected | Number of Nonconforming |
|--------|---------------------|-------------------------|
| 1 | 1750 | 47 |
| 2 | 1750 | 42 |
| 3 | 1750 | 48 |
| 4 | 1750 | 58 |
| 5 | 1750 | 32 |
| 6 | 1750 | 38 |
| 7 | 1750 | 53 |
| 8 | 1750 | 68 |
| 9 | 1750 | 45 |
| 10 | 1750 | 37 |
| 11 | 1750 | 57 |
| 12 | 1750 | 38 |
| 13 | 1750 | 53 |
| 14 | 1750 | 37 |
| 15 | 1750 | 39 |
| 16 | 1750 | 51 |
| 17 | 1750 | 44 |
| 18 | 1750 | 61 |
| 19 | 1750 | 48 |
| 20 | 1750 | 56 |
| 21 | 1750 | 48 |
| 22 | 1750 | 40 |
| 23 | 1750 | 47 |
| 24 | 1750 | 25 |
| 25 | 1750 | 35 |

*Note: Round all calculations to four decimal points.

Using the data:

- (a) Calculate the trial central line and control limits for a p chart. (10 marks)
- (b) Plot the trial central line and control limits values for a p chart on graph paper. (5 marks)
- (c) Calculate the revised central line and control limits if there are any out-of-control points in Q5(b) with the assumption that causes of defects are assignable. (10 marks)

- Q6 The ZZ-400 manufacturing team used an affinity diagram to organize its list of potential performance indicators of its operations. Because the team works a shift schedule and members could not meet to do the affinity diagram together, they modified the procedure. They wrote each idea on a sticky note and put all the notes randomly on a rarely used door. Table Q6 shows the list that the team members brainstormed.

Table Q6: List of potential performance indicators

| Possible Performance Measures | |
|-------------------------------|-----------------------------|
| % purity | # of OSHA recordable |
| % trace metals | # of customer returns |
| Maintenance costs | Customer complaints |
| # of emergency jobs | Overtime/total hours worked |
| lbs. Produced | \$/lb. produced |
| Environmental accidents | Raw material utilization |
| Material costs | Yield |
| Overtime costs | Utility cost |
| # of pump seal failures | ppm water |
| Viscosity | Color |
| C _p values | Service factor |
| Safety | Time between turnarounds |
| Days since last lost-time | Hours worked/employee |
| % rework or reject | lbs. Waste |
| Hours downtime | Housekeeping score |
| % uptime | % capacity field |

As the quality manager of the ZZ-400, you have reviewed and organized the notes into five major groups (product quality, maintenance, manufacturing cost, safety and environmental, and volume).

Develop an affinity diagram for each group.

(25 marks)

END OF QUESTION PAPER

FINAL EXAMINATION

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Factors for Computing Central Lines and 3σ Control Limits for Variable Charts

| Sample Size | CHART FOR AVERAGES | | CHART FOR STANDARD DEVIATIONS | | |
|-------------|----------------------------|-------|-------------------------------|----------------------------|-------|
| | Factors for Control Limits | | Factor for Central Line | Factors for Control Limits | |
| n | A_2 | A_3 | C_4 | B_3 | B_4 |
| 2 | 1.880 | 2.659 | 0.7979 | 0 | 3.267 |
| 3 | 1.023 | 1.954 | 0.8862 | 0 | 2.568 |
| 4 | 0.729 | 1.628 | 0.9213 | 0 | 2.266 |
| 5 | 0.577 | 1.427 | 0.9400 | 0 | 2.089 |
| 6 | 0.483 | 1.287 | 0.9515 | 0.030 | 1.970 |
| 7 | 0.419 | 1.182 | 0.9594 | 0.118 | 1.882 |
| 8 | 0.373 | 1.099 | 0.9650 | 0.185 | 1.815 |

| Sample Size | CHART FOR RANGES | | | | | Chart for Medians |
|-------------|-------------------------|----------------------------|-------------------------------|-------|-------|-------------------|
| | CHART FOR AVERAGES | | CHART FOR STANDARD DEVIATIONS | | | |
| | Factor for Central Line | Factors for Control Limits | | | | |
| n | d_2 | D_3 | D_4 | D_5 | D_6 | A_5 |
| 2 | 1.128 | 0 | 3.267 | 0 | 3.865 | 2.224 |
| 3 | 1.693 | 0 | 2.574 | 0 | 2.745 | 1.265 |
| 4 | 2.059 | 0 | 2.282 | 0 | 2.375 | 0.829 |
| 5 | 2.326 | 0 | 2.114 | 0 | 2.179 | 1.712 |
| 6 | 2.534 | 0 | 2.004 | 0 | 2.055 | 0.562 |
| 7 | 2.704 | 0.076 | 1.924 | 0.078 | 1.967 | 0.520 |
| 8 | 2.847 | 0.136 | 1.864 | 0.139 | 1.901 | 0.441 |