UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2018/2019

COURSE NAME	:	PRODUCTION CONTROL
COURSE CODE	:	BBM 40402
PROGRAMME CODE	:	BBA
EXAM DATE	:	DECEMBER 2018 / JANUARY 2019
DURATION	:	2 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

THIS EXAM PAPER CONTAINS **NINE (9)** PAGES

Q1 a) Explain four (4) types of phase in the lifecycle of a product.

(4 marks)

b) Explain the difference(s) between CAD, CAM and CAE by using an example.

(6 marks)

c) Brodential Takaful promotes their insurance plan packages by mailing thousands of individually composed and typed letters to potential clients. A time study has been conducted on the task of preparing letters for mailing. On the basis of the following observations, Brodential takaful wants to develop a time standard for this task. The company's personal, delay and fatique allowance factor is 15%.

Using time study approach, and assuming letters are prepared by the two clerks, the company has summarized their findings for 5 random cycles of letters preparation in Table Q1(c).

Table Q1(c): Time Study for Letters Preparation

Work Elements	**Observation (Time in Minutes)**				
	1	2	3	4	5
1. Compose and type letter	8	10	9	21*	11
2. Type envelope address	2	3	2	1	3
3. Stuff, stamp, seal, and sorting	2	1	5*	2	1

*Process error

(i) Assume that work element 1 and 2 have 115% performance rating and work element 3 have 105% performance rating, calculate the standard time for the whole letter preparation.

(7 marks)

(ii) With assumptions that the company has 28 full working days per month with 8 hours daily, estimate roughly the number of letters that can be email to the potential clients per month.

(4 marks)

(iii) Estimate the salary of a clerk daily if the cost for this process per letter is RM 3.50 using your estimation in Q1(ii).

(4 marks)

Q2 a) Explain the two (2) factors influencing layout planning.

(4 marks)

b) Describe the difference(s) between product and process layout by using an example.

(6 marks)

c) The performance of wing assembly line in CRK Aero Sdn.Bhd is presented as below:

Table Q2(c): Wing Assembly Line Process

Task	Assembly Time (minutes)	Task Must Follow Task Listed Below
A	10	-
B	11	A
C	5	B
D	4	B
E	11	A
F	3	C,D
G	7	F
H	11	E
I	3	G, H

(i) Draw a precedence diagram for this operation.

(4 marks)

(ii) Assuming 8 hours of working per day, and daily production of 30 units of wing assembly, calculate the cycle time.

(3 marks)

(iii) Calculate the theoretical minimum number of workstations.

(3 marks)

(iv) Balance the assembly line by assigning tasks into workstations. Calculate the overall efficiency of this balanced assembly line.

(5 marks)

Q3 a) Explain the four (4) types of inventory.

(4 marks)

b) Describe the three (3) types of cost in an inventory system.

(6 marks)

c) A quality engineer is monitoring the performance of 20 assembly lines of a new Macbook Air. The performance for each assembly line (measured using defects per 800 products) for a particular day is summarised as in Table Q3(c).

Table Q3(c): Defects per Assembly Line

Line No.	Defects	Line No.	Defects
A	7	K	17
B	5	L	9
C	20	M	14
D	10	N	4
E	11	O	9
F	8	P	8
G	12	Q	12
H	9	R	4
I	6	S	6
J	13	T	16

(i) Determine the Upper Control Limit (UCL) and Lower Control Limit (LCL) for a 99.73% (3-sigma confidence level).

(4 marks)

(ii) Plot a simple 3-sigma *p*-chart using information from Q3(c)(i) on graph paper.

(8 marks)

(iii) Determine the assembly line(s) with unacceptable defect rates (if any) and provide evaluation on what should be done with the problematic assembly line(s).

(3 marks)

Q4 a) Explain the three (3) integrated systems include in ERP.

(6 marks)

b) Bantai Medivest, a company that markets needles to hospitals, would like to reduce its inventory costs by determining the optimal number of needles to obtain per order. The annual demand for these needles is 1,000 units, setup or ordering cost is RM10 per order; and the annual holding cost per unit is RM0.50. This company has a 250 working days per year.

(i) Calculate the optimal number of units per order.

(2 marks)

(ii) Calculate the total annual inventory cost.

(2 marks)

(iii) Due to weaker currency rates, annual setup cost and holding cost have experienced 10% increment while annual demand has dropped to 700 units. Calculate the changes compare to the original total annual inventory cost.

(6 marks)

c) A machining centre has received job tasks as shown in Table Q4(c). Jobs are logged as they arrived. Choose the best job sequence according to:

Table Q4(c): Job Tasks for Machining Centre

Job	Processing (Days)	Due Date (Days)
A	3	6
B	1	4
C	4	10
D	6	12
E	5	5

(i) Earliest Due Date (EDD)
(ii) First-come, first-served (FCFS)
(iii) Shortest Processing Time (SPT)

(9 marks)

– END OF QUESTIONS –

FINAL EXAMINATION

SEMESTER / SESSION : SEMESTER I / 2018/2019 COURSE : BBA
SUBJECT NAME : PRODUCTION CONTROL SUBJECT CODE : BBM 40402

LIST OF FORMULA

Time Studies

Average observed time = (sum of times recorded) / number of observations

Normal time = (average observed time) x (performance rating factor)

Standard time = (total normal time) / (1 – allowance factor)

$$s = \sqrt{\frac{\Sigma(x-\bar{x})^2}{n-1}} = \sqrt{\frac{\Sigma x^2 - \frac{(\Sigma x)^2}{n}}{n-1}}$$

$$n = \left(\frac{zs}{h\bar{x}}\right)^2$$

n = Required sample size
z = number of standard deviations required for desired level of confidence (from table)
s = standard deviation of the initial sample
$\bar{x}$ = mean of sample size
h = accuracy level desired in percent of the job element, expressed as decimal (5% = .05)

$$n = \frac{z^2 p(1-p)}{h^2}$$

n = Required sample size
z = number of standard deviations required for desired level of confidence (from table)
p = estimated value of sample proportion (of time worker is observed busy or idle)
h = acceptable error level, in percentage decimals (5% = .05)

Process Layout Analysis

$$minimize\ cost = \sum_{i=1}^{n}\sum_{j=1}^{n} X_{ij}C_{ij}$$

$n = total\ number\ of\ work\ centers\ or\ depts$

$i, j = individual\ departments$

$X_{ij} = number\ of\ loads\ moved\ from\ dept.i\ to\ dept.j$

$C_{ij} = cost\ to\ move\ a\ load\ between\ dept.i\ and\ dept.j$

FINAL EXAMINATION

SEMESTER / SESSION : SEMESTER I / 2018/2019 COURSE : BBA
SUBJECT NAME : PRODUCTION CONTROL SUBJECT CODE : BBM 40402

LIST OF FORMULA

Assembly Line Balancing

Cycle Time = Production time available per day / units required per day

$$minimum\ workstations = \frac{\sum_{i=1}^{n} T_i}{cycle\ time}$$

$$Efficiency = \frac{\sum Task\ times}{(actual\ number\ of\ workstations) \times (Largest\ assigned\ cycle\ time)}$$

Inventory Control

$$EOQ = \sqrt{\frac{2DS}{H}}$$

Total Cost = Carrying costs + Ordering Costs + Puchase Costs

$$TC = \frac{QH}{2} + \frac{DS}{Q} + PD$$

D = Demand, S = Ordering Cost, H = Holding Cost, Q = units per order

Statistical Process Control: Mean Chart

Upper Control Limit (UCL) = $\bar{\bar{x}} + z\sigma_{\bar{x}}$
Lower Control Limit (LCL) = $\bar{\bar{x}} - z\sigma_{\bar{x}}$

$\bar{\bar{x}}$ = mean of the sample means or a target value set for the process
z = number of normal standard deviations (2 for 95.45%, 3 for 99.73%)
$\sigma_{\bar{x}}$ = standard deviation of the sample means = $\frac{\sigma}{\sqrt{n}}$
σ = population (process) standard deviation
n = sample size

Statistical Process Control: *p*- Chart

$$\sigma_{\hat{p}} = \sqrt{\frac{\bar{p}(1-\bar{p})}{n}}$$

$$UCL_p = \bar{p} + z\sigma_{\hat{p}}$$

$$LCL_p = \bar{p} - z\sigma_{\hat{p}}$$

$\bar{p}$ = mean fraction defective in sample
z = number of standard deviations (2 for 95.45%, 3 for 99.73%)
$\sigma_{\hat{p}}$ = standard deviation of the sampling distribution

FINAL EXAMINATION

SEMESTER / SESSION : SEMESTER I / 2018/2019 COURSE : BBA
SUBJECT NAME : PRODUCTION CONTROL SUBJECT CODE : BBM 40402

LIST OF FORMULA

Job Sequencing

Average completion time = Sum of total flow time / Number of jobs

Utilization metric = Total job work (Processing Time) / Sum of total flow time

Average number of jobs in the system = Sum of total flow time / Total job work (processing) time

Average job lateness = Total late days / Number of jobs

Critical Ratio (CR) = Time Remaining / Worksdays Remaining = (Due date – Today's Due) / Work time remaining

Just-In-Time Inventory & Scheduling

$$Q^* = \sqrt{\frac{2DS}{H[1-(d/p)]}}$$

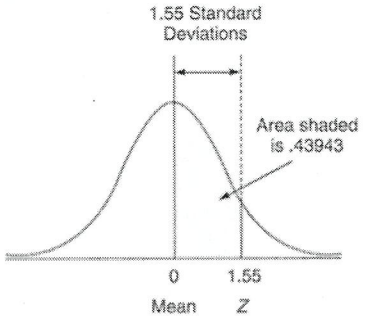
D = Annual Demand, S = Setup Cost, H = Holding Cost, d = Daily demand, p = Daily production

Number of Kanbans = (Demand during lead time + Safety Stock) / Size of container

FINAL EXAMINATION

SEMESTER / SESSION : SEMESTER I / 2018/2019 COURSE : BBA
SUBJECT NAME : PRODUCTION CONTROL SUBJECT CODE : BBM 40402

NORMAL DISTRIBUTION TABLE



As an alternative to Table I.1, the numbers in Table I.2 represent the proportion of the total area away from the mean, μ, to one side. For example, the area between the mean and a point that is 1.55 standard deviations to its right is .43943.

TABLE I.2

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.00000	.00399	.00798	.01197	.01595	.01994	.02392	.02790	.03188	.03586
0.1	.03983	.04380	.04776	.05172	.05567	.05962	.06356	.06749	.07142	.07535
0.2	.07926	.08317	.08706	.09095	.09483	.09871	.10257	.10642	.11026	.11409
0.3	.11791	.12172	.12552	.12930	.13307	.13683	.14058	.14431	.14803	.15173
0.4	.15542	.15910	.16276	.16640	.17003	.17364	.17724	.18082	.18439	.18793
0.5	.19146	.19497	.19847	.20194	.20540	.20884	.21226	.21566	.21904	.22240
0.6	.22575	.22907	.23237	.23565	.23891	.24215	.24537	.24857	.25175	.25490
0.7	.25804	.26115	.26424	.26730	.27035	.27337	.27637	.27935	.28230	.28524
0.8	.28814	.29103	.29389	.29673	.29955	.30234	.30511	.30785	.31057	.31327
0.9	.31594	.31859	.32121	.32381	.32639	.32894	.33147	.33398	.33646	.33891
1.0	.34134	.34375	.34614	.34850	.35083	.35314	.35543	.35769	.35993	.36214
1.1	.36433	.36650	.36864	.37076	.37286	.37493	.37698	.37900	.38100	.38298
1.2	.38493	.38686	.38877	.39065	.39251	.39435	.39617	.39796	.39973	.40147
1.3	.40320	.40490	.40658	.40824	.40988	.41149	.41309	.41466	.41621	.41174
1.4	.41924	.42073	.42220	.42364	.42507	.42647	.42786	.42922	.43056	.43189
1.5	.43319	.43448	.43574	.43699	.43822	.43943	.44062	.44179	.44295	.44408
1.6	.44520	.44630	.44738	.44845	.44950	.45053	.45154	.45254	.45352	.45449
1.7	.45543	.45637	.45728	.45818	.45907	.45994	.46080	.46164	.46246	.46327
1.8	.46407	.46485	.46562	.46638	.46712	.46784	.46856	.46926	.46995	.47062
1.9	.47128	.47193	.47257	.47320	.47381	.47441	.47500	.47558	.47615	.47670
2.0	.47725	.47778	.47831	.47882	.47932	.47982	.48030	.48077	.48124	.48169
2.1	.48214	.48257	.48300	.48341	.48382	.48422	.48461	.48500	.48537	.48574
2.2	.48610	.48645	.48679	.48713	.48745	.48778	.48809	.48840	.48870	.48899
2.3	.48928	.48956	.48983	.49010	.49036	.49061	.49086	.49111	.49134	.49158
2.4	.49180	.49202	.49224	.49245	.49266	.49286	.49305	.49324	.49343	.49361
2.5	.49379	.49396	.49413	.49430	.49446	.49461	.49477	.49492	.49506	.49520
2.6	.49534	.49547	.49560	.49573	.49585	.49598	.49609	.49621	.49632	.49643
2.7	.49653	.49664	.49674	.49683	.49693	.49702	.49711	.49720	.49728	.49736
2.8	.49744	.49752	.49760	.49767	.49774	.49781	.49788	.49795	.49801	.49807
2.9	.49813	.49819	.49825	.49831	.49836	.49841	.49846	.49851	.49856	.49861
3.0	.49865	.49869	.49874	.49878	.49882	.49886	.49889	.49893	.49897	.49900
3.1	.49903	.49906	.49910	.49913	.49916	.49918	.49921	.49924	.49926	.49929