UNIVERISTI SAINS MALAYSIA
Master of Business Administration

Semester III, Academic Session 1998/99

April 1999

ASU 662 - QUALITY AND PRODUCTIVITY MANAGEMENT

Time: [3 hours]

Instructions:

Please ensure that this examination paper contains 6 (SIX) printed pages before you begin. Answer any FOUR (4) questions.

1a. What do you understand by productivity? What are the major issues related to productivity measurements?

1b. Suppose you are to develop an integrated approach to productivity measurement for a management consultancy firm. The firm main activities are consultancy work and training and development. The areas this firm provide expertise are in market surveys and problem solving. Its training division provides training in management to corporate clients as well as short courses to the general public. It also has a marketing team to source for business. Devise an integrated model of productivity measurements that is useful for the management of this firm.

(25 marks)

2a. Job Design is considered as one of the major factors that influence labour productivity. One of the two major approaches to job design is the behavioural or motivation approach. Describe the Hackman and Oldham model of motivation and how this can be applied to improve productivity.

2b. A grocery chain sells prewrapped flowers in its stores. The flowers are selected and wrapped in a central facility and then distributed to the stores in the area. A time study of the operation for assembling and wrapping a bouquet has been conducted, with the following results.

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Elements	Cycle time (min)						Performance rating
	1	2	3	4	5	6	
1. Prepare paper wrapping	0.05	0.61	1.26	2.00	2.61	3.22	1.10
2. Select flowers	0.22	0.75	1.47	2.18	2.72	3.37	0.95
3. Arrange flowers and secure	0.43	1.03	1.81	2.43	3.01	3.70	1.05
4. Place bouquet in box for transport	0.51	1.15	1.88	2.52	3.12	3.81	0.90

Determine the normal time, and using a 15% allowance factor, find the standard time for this job. How many bouquets could be made in a 3-hour period?

(25 marks)

3a. The following table gives the average and range in kg. for tensile tests on improved plastic cords. The subgroup or sample size is 4.

Sample No	$\bar{X}$	R	Sample No	$\bar{X}$	R
1	476	32	14	482	22
2	466	24	15	506	23
3	484	32	16	496	23
4	466	26	17	478	25
5	470	24	18	484	24
6	494	24	19	506	23
7	486	28	20	476	25
8	496	23	21	485	29
9	488	24	22	490	25
10	482	26	23	463	22
11	498	25	24	469	27
12	464	24	25	474	22
13	484	24			

i. Determine the trial central line and control limits. All points out-of-control are assumed to be due to assignable causes and determine the revised limits and central line.

ii. Supposing the specification limits are 480 ±10 kg. What are the process capability indices C_p and C_{pk}

[Note : Control Limits are : $\bar{\bar{X}} \pm A_2\bar{R}$; and $D_4\bar{R}$; $D_3\bar{R}$; $\hat{\sigma} = \frac{\bar{R}}{d_2}$]

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3b. Why is Deming's very much opposed to acceptance sampling or inspection. Describe the major features of the MIL-STD 105E used in acceptance sampling. Devise a single sampling plan to inspect lots of sizes 2500 with an AQL of 1% with normal inspection and general inspection level II.

(25 marks)

4. Quality Management is not merely processes, procedures and documentations, but it's a cultural and behavioral phenomenon. Is this statement true? Discuss.

(25 marks)

5. Discuss the importance, role and implications of the Malcom Baldrige National Quality Award in quality improvement of organizations. How similar or different is Malcom Baldrige award from ISO 9000 standards?

(25 marks)

6. Read the case on Milt and Michael's Cleaning Carefully and design the quality program. Consider the following issues:

a. Where should inspection(s) occur?
b. How will accountability be achieved?
c. What factors (variables, attributes, and other considerations) should be checked?
d. What records should be kept to measure the success of the program in terms of costs, quality performance, and service to the customer?

(25 marks)

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Factors for Computing Center Line and Three-Sigma Control Limits

Observations in Sample, n	$\bar{X}$-Charts			s-Charts						R-Charts						
	Factors for Control Limits			Factors for Center Line		Factors for Control Limits				Factors for Center Line		Factors for Control Limits				
	A	A_2	A_3	c_4	$1/c_4$	B_3	B_4	B_5	B_6	d_2	$1/d_2$	d_3	D_1	D_2	D_3	D_4
2	2.121	1.880	2.659	0.7979	1.2533	0	3.267	0	2.606	1.128	0.8865	0.853	0	3.686	0	3.267
3	1.732	1.023	1.954	0.8862	1.1284	0	2.568	0	2.276	1.693	0.5907	0.888	0	4.358	0	2.574
4	1.500	0.729	1.628	0.9213	1.0854	0	2.266	0	2.088	2.059	0.4857	0.880	0	4.698	0	2.282
5	1.342	0.577	1.427	0.9400	1.0638	0	2.089	0	1.964	2.326	0.4299	0.864	0	4.918	0	2.114
6	1.225	0.483	1.287	0.9515	1.0510	0.030	1.970	0.029	1.874	2.534	0.3946	0.848	0	5.078	0	2.004
7	1.134	0.419	1.182	0.9594	1.0423	0.118	1.882	0.113	1.806	2.704	0.3698	0.833	0.204	5.204	0.076	1.924
8	1.061	0.373	1.099	0.9650	1.0363	0.185	1.815	0.179	1.751	2.847	0.3512	0.820	0.388	5.306	0.136	1.864
9	1.000	0.337	1.032	0.9693	1.0317	0.239	1.761	0.232	1.707	2.970	0.3367	0.808	0.547	5.393	0.184	1.816
10	0.949	0.308	0.975	0.9727	1.0281	0.284	1.716	0.276	1.669	3.078	0.3249	0.797	0.687	5.469	0.223	1.777
11	0.905	0.285	0.927	0.9754	1.0252	0.321	1.679	0.313	1.637	3.173	0.3152	0.787	0.811	5.535	0.256	1.744
12	0.866	0.266	0.886	0.9776	1.0229	0.354	1.646	0.346	1.610	3.258	0.3069	0.778	0.922	5.594	0.283	1.717
13	0.832	0.249	0.850	0.9794	1.0210	0.382	1.618	0.374	1.585	3.336	0.2998	0.770	1.025	5.647	0.307	1.693
14	0.802	0.235	0.817	0.9810	1.0194	0.406	1.594	0.399	1.563	3.407	0.2935	0.763	1.118	5.696	0.328	1.672
15	0.775	0.223	0.789	0.9823	1.0180	0.428	1.572	0.421	1.544	3.472	0.2880	0.756	1.203	5.741	0.347	1.653
16	0.750	0.212	0.763	0.9835	1.0168	0.448	1.552	0.440	1.526	3.532	0.2831	0.750	1.282	5.782	0.363	1.637
17	0.728	0.203	0.739	0.9845	1.0157	0.466	1.534	0.458	1.511	3.588	0.2787	0.744	1.356	5.820	0.378	1.622
18	0.707	0.194	0.718	0.9854	1.0148	0.482	1.518	0.475	1.496	3.640	0.2747	0.739	1.424	5.856	0.391	1.608
19	0.688	0.187	0.698	0.9862	1.0140	0.497	1.503	0.490	1.483	3.689	0.2711	0.734	1.487	5.891	0.403	1.597
20	0.671	0.180	0.680	0.9869	1.0133	0.510	1.490	0.504	1.470	3.735	0.2677	0.729	1.549	5.921	0.415	1.585
21	0.655	0.173	0.663	0.9876	1.0126	0.523	1.477	0.516	1.459	3.778	0.2647	0.724	1.605	5.951	0.425	1.575
22	0.640	0.167	0.647	0.9882	1.0119	0.534	1.466	0.528	1.448	3.819	0.2618	0.720	1.659	5.979	0.434	1.566
23	0.626	0.162	0.633	0.9887	1.0114	0.545	1.455	0.539	1.438	3.858	0.2592	0.716	1.710	6.006	0.443	1.557
24	0.612	0.157	0.619	0.9892	1.0109	0.555	1.445	0.549	1.429	3.895	0.2567	0.712	1.759	6.031	0.451	1.548
25	0.600	0.153	0.606	0.9896	1.0105	0.565	1.435	0.559	1.420	3.931	0.2544	0.708	1.806	6.056	0.459	1.541

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Sample Size Code Letters

Lot or Batch Size	Special Inspection Levels				General Inspection Levels		
	S–1	*S–2*	*S–3*	*S–4*	*I*	*II*	*III*
2 to 8	A	A	A	A	A	A	B
9 to 15	A	A	A	A	A	B	C
16 to 25	A	A	B	B	B	C	D
26 to 50	A	B	B	C	C	D	E
51 to 90	B	B	C	C	C	E	F
91 to 150	B	B	C	D	D	F	G
151 to 280	B	C	D	E	E	G	H
281 to 500	B	C	D	E	F	H	J
501 to 1,200	C	C	E	F	G	J	K
1,201 to 3,200	C	D	E	G	H	K	L
3,201 to 10,000	C	D	F	G	J	L	M
10,001 to 35,000	C	D	F	H	K	M	N
35,001 to 150,000	D	E	G	J	L	N	P
150,001 to 500,000	D	E	G	J	M	P	Q
500,001 and over	D	E	H	K	N	Q	R

Source: ASQC (1981), ANSI/ASQC Z1.4–1981: *American National Standard—Sampling Procedures and Tables for Inspection by Attributes.* Reprinted with permission of ASQC.

Master Table for Single Sampling Plans: Normal Inspection

Sample Size Code Letter	Sample Size	Acceptable Quality Levels (Normal Inspection)																															
		0.010	0.015	0.025	0.040	0.065	0.10	0.15	0.25	0.40	0.65	1.0	1.5	2.5	4.0	6.5	10	15	25	40	65	100	150	250	400	650	1000
		Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re
A	2	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	30 31
B	3	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	2 3	3 4	5 6	7 8	10 11	14 15	21 22	30 31	44 45
C	5	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	0 1	0 1	1 2	1 2	3 4	5 6	7 8	10 11	14 15	21 22	30 31	44 45	↑
D	8	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	1 2	2 3	2 3	5 6	7 8	10 11	14 15	21 22	30 31	44 45	↑	↑
E	13	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↑	↓	1 2	2 3	3 4	3 4	7 8	10 11	14 15	21 22	30 31	44 45	↑	↑	↑
F	20	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	1 2	2 3	3 4	5 6	5 6	10 11	14 15	21 22	30 31	44 45	↑	↑	↑	↑
G	32	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↑	↑	↑	↑	↑	↑
H	50	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↑	↑	↑	↑	↑	↑	↑
J	80	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↑	↑	↑	↑	↑	↑	↑	↑
K	125	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↑	↑	↑	↑	↑	↑	↑	↑	↑
L	200	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
M	315	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
N	500	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
P	800	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
Q	1,250	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
R	2,000	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑

↓ = Use first sampling plan below arrow. If sample size equals, or exceeds, lot or batch size, do 100% inspection.

↑ = Use first sampling plan above arrow.

Ac = Acceptance number.

Re = Rejection number.

Source: ASQC (1981), ANSI/ASQC Z1.4–1981: *American National Standard—Sampling Procedures and Tables for Inspection by Attributes.* Reprinted with the permission of ASQC.

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CASE

Milt and Michael's Cleaning

The owner of Milt and Micheal's Cleaning has decided that a quality improvement program must be implemented in its dry cleaning service. Customers bring clothes to one of five stores or pickup stations. Orders are then delivered to the cleaning plant twice (morning and afternoon) each day, with deliveries of orders being made to the stores at the same time, allowing for same-day service by customer request.

The stores are opened at 7:00 A.M. by a full-time employee. This person is relieved at 3:00 P.M. by a part-time employee, who closes the store at 6:00 P.M. When the clothes are received from the customer, a five-ply ticket showing the customer name, phone number, due date, and special requests is prepared. One ply is given to the customer as a claim check, and the store keeps one ply (to show what they have in process). The clothes and the remaining plies of the ticket are put in a nylon laundry bag for delivery to the plant.

The cleaning plant is has the following departments:

Mark-in. Each order is removed from the bag; items are tagged for identification later and sorted into large buggies according to due date, type of garment, and cleaning requirements. The buggies are moved to the cleaning department as they become full. Also at mark-in, garments are checked for spots, stains, tears, or other special handling. The problem is written on a strip-tag (a ½ inch wide paper tape) and attached to the garment with the identification tag.

Cleaning. The buggies are emptied into the cleaning machine one item at a time to allow for inspection. The primary items checked for are foreign objects and spots and stains requiring special attention. For example, an ink pen left in a pocket could ruin the whole load. As items are removed from the cleaning machine, they are placed on hangers and moved by conveyor to the pressing department.

Pressing. There are four presses: one for silks, one for pants, and two general-purpose. On an ordinary day, three of the presses will be operating, but which three of the four are operating will depend upon the total demand and product mix that particular day. As items are pressed, they are placed on a conveyor that delivers them to the assembly department.

Assembly. Cleaned items are grouped into customer orders, bagged, and put in the appropriate queue for delivery to the respective store. At this time, two plies (of the remaining three) of the ticket are attached to the order, and one ply stays at the plant to show this order was completed. When the customer picks up the order, one ply will stay on the order.

The store will retain the last ply and pull the corresponding ply from its work-in-process file to show that this order is complete.

At present, a majority of the employees are cross-trained to allow for flexibility. The table indicates the production employees and the positions for which they are trained. A P indicates this is the primary duty or the one the employee performs most often. A check indicates that the employee is also trained in that function.

		PRESSES		
Employee	*Cleaning*	*General Purpose*	*Silks*	*Pants*
David	P	✓		✓
Tasha	✓	✓		P
Len	✓	P	✓	
Mary		✓	P	✓
Betty (part-time)	✓	✓		✓
Mike (part-time)	✓	✓		✓

For example, one day David may only clean; the next day he cleans a while and then presses pants. This presents a problem in determining who put a double crease in Mrs. Jones's slacks, but the owner believes this flexibility in scheduling is valuable and must be maintained.

Although Milt and Michael's Cleaning is larger-than-average cleaning operation, total annual revenues are approximately $500,000. Therefore, any suggestions must be relatively inexpensive.

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