UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2016/2017

COURSE NAME   :   INDUSTRIAL ENGINEERING

COURSE CODE   :   DAM 31802

PROGRAMME CODE   :   DAM

EXAMINATION DATE   :   JUN 2017

DURATION   :   2 HOUR 30 MINUTE

INSTRUCTION   :   ANSWERS **FOUR (4)**QUESTIONS ONLY

THIS QUESTION PAPER CONSISTS OF **TWENTY (20)** PAGES

TERBUKA

BAHASA MELAYU

S1   (a)   Senaraikan **empat (4)** teknik penentuan lokasi alternatif .

(4 markah)

       (b)   Jelaskan terminologi ergonomik di bawah:

            (i)   Biomekanik

(3 markah)

            (ii)   Fisiologi kerja

(3 markah)

       (c)   Syarikat DRC-Hicom merupakan pembekal baru alat ganti kereta kepada Proton. Berdasarkan **Jadual 1**, Syarikat Proton memerlukan 35,000 unit alat ganti kereta sebulan iaitu suatu jumlah yang tidak mampu dibekalkan oleh kilang-kilang sedia ada Syarikat DRC-Hicom. Oleh itu, Syarikat DRC-Hicom perlu membina sebuah kilang tambahan di salah satu lokasi alternatif iaitu sama ada di Perak atau di Johor. Kos pengangkutan dan kos pengeluaran mengikut lokasi terlibat ditunjukkan pada **Jadual 2**. Dengan menggunakan "Kaedah Pengangkutan", tentukan:

            (i)   Jumlah kos optimum, jika Perak merupakan lokasi pilihan untuk kilang terbaru ini.

(7 markah)

            (ii)   Jumlah kos optimum, jika Johor merupakan lokasi pilihan untuk kilang terbaru ini.

(7 markah)

            (iii)   Dengan membandingkan jumlah kos optimum di antara Perak dan Johor, di manakah lokasi pilihan yang terbaik?

(1 markah)

S2   (a)   Senaraikan **empat (4)** keadaan kerja yang perlu dipertimbangkan untuk kajian pengukuran kerja.

(4 markah)

       (b)   Jelaskan terminologi pengukuran kerja di bawah:

            (i)   Kajian Kerja

(3 markah)

            (ii)   Kajian Pergerakan

(3 markah)

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(c) Kajian pensampelan kerja telah diadakan selama 5 hari berturut-turut di sebuah kilang pemasangan radio. Sebanyak 50 pemerhatian telah dibuat dalam tempoh 8 jam bekerja bagi setiap hari seperti di **Jadual 3**. Bilangan unit yang berjaya dihasilkan adalah 3,000 unit untuk seminggu. Kilang ini beroperasi 5 hari seminggu dengan mengambil kira kadaran dan kelegaan sebanyak 98% dan 10%. Kirakan masa piawai dalam (min/unit) bagi proses pemasangan terbabit.

(3 markah)

(d) Satu kajian pensampelan kerja yang dilakukan di sebuah kilang salutan logam telah menghasilkan data dalam **Jadual 4**. Waktu operasi kilang adalah 8 jam/hari, 5 hari/minggu, 4 minggu/bulan.

   (i) Kirakan masa piawai dalam (min/unit) untuk proses salutan.

(3 markah)

   (ii) Tentukan tempoh kerja lebih masa setiap hari yang harus diatur sekiranya jumlah permintaan ialah 14,000 unit sebulan dan hanya 75% pekerja yang sanggup bekerja lebih masa pada setiap hari bekerja.

(9 markah)

S3 (a) Senaraikan **empat (4)** sebab keperluan kualiti dalam industri.

(4 markah)

(b) Jelaskan terminologi kawalan kualiti di bawah:

   (i) Deming "Basic Message"

(3 markah)

   (ii) Carta Kawalan

(3 markah)

(c) Data di **Jadual 5** menunjukkan sebanyak 20 sub-kumpulan garispusat aci dengan n=4 diambil daripada proses larik

   (i) Hitung dan lengkapkan **Jadual 5** ini.

(2 markah)

   (ii) Sediakan Carta X-bar dan Carta R bagi proses ini. Rujuk **Jadual 6** dan gunakan **Rajah S3(c)(i)** dan **Rajah S3(c)(ii)** untuk menjawab soalan-soalan.

(13 markah)

S4 (a) Senaraikan **empat (4)** langkah di dalam proses ramalan.

(4 markah)

(b) Terangkan dengan terperinci "Struktur Produk" dalam perancangan kapasiti.

(6 markah)

(c) Ramalan merupakan suatu kaedah menganggarkan kuantiti permintaan pelanggan pada masa hadapan terhadap sesuatu produk yang perlu disediakan. Berdasarkan **Jadual 7** kirakan:

(i) Ramalan unit peti TV untuk bulan Oktober dengan menggunakan kaedah "Pelincinan Eksponen Mudah" dengan mengambil $\alpha = 0.3$. Anggapkan ramalan bagi bulan Julai ialah 2,000 unit.

(5 markah)

(ii) Jumlah braket yang diperlukan untuk memenuhi nilai ramalan pada soalan (i) diatas. Rujuk **Rajah S4(c)** struktur produk untuk menjawab soalan.

(5 markah)

(iii) Bahan mentah braket yang perlu dibeli. Tiga jenis mesin digunakan untuk proses pembuatan braket tersebut. Kadar skrap pada mesin pertama ialah 4%, mesin kedua ialah 3% dan mesin ketiga ialah 2.5%.

(5 markah)

S5 (a) Takrifkan terminologi kos inventori di bawah:

(i) Kos Pesanan

(2 markah)

(ii) Kos Persediaan

(2 markah)

(b) Syarikat Sonic Computer menggunakan 1,000 transistor setiap bulan bagi proses pemasangan komputer mereka.. Kos seunit transistor ialah $10, dan kos pegangan inventori seunit bagi masa setahun ialah $3. Kos pesanan ialah $30 per pesanan dan syarikat ini beroperasi 200 hari bekerja setahun. Tentukan:

(i) Kuantiti pesanan optimum

(2 markah)

(ii) Anggaran bilangan pesanan setiap tahun

(2 markah)

(iii) Anggaran sela masa antara pesanan

(2 markah)

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(c) **Jadual 8** menunjukkan urutan tugas di Syarikat ABC. Sediakan **Jadual 9** dengan lengkap bersama jawapan yang betul. Setiap jawapan mesti disokong oleh pengiraan yang berkaitan.

Nota:
FCFS: First Come, First Served,
DDATE: Earlier Due Date,
SPT: Shortest Processing Time

(15 markah)

S6 (a) Senaraikan **empat (4)** jenis "pembaziran" di dalam lini pengeluaran.

(4 markah)

(b) Jelaskan **tiga (3)** tujuan perlaksanaan Just-in-Time (JIT) dalam lini pengeluaran.

(6 markah)

(c) **Rajah S6** menunjukkan struktur produk A1. Maklumat permintaan pelanggan dan status inventori bagi setiap item adalah ditunjukkan dalam **Jadual 10** dan **Jadual 11**. Sediakan 'material requirement planning' (MRP) bagi item G dengan FOQ=300 dan stok keselamatan=90. Isikan maklumat berkaitan dalam **Jadual 12** dan sertakannya sekali dengan skrip jawapan anda.

(15 markah)

-SOALAN TAMAT-

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BAHASA INGGERIS

Q1   (a)   List down **four (4)** techniques in evaluating alternative locations.

(4 marks)

(b)   Describe the ergonomics terminology below:

(i)   Biomechanics

(3 marks)

(ii)   Work physiology

(3 marks)

(c)   DRC-Hicom Company is new supplier for Proton Bhd. According to **Table 1**, Proton Company need 35,000 units of spare part per month which the amount cannot be supplied by existing factories of DRC-Hicom Company. Hence, DRC-Hicom Company needs to build an addditional factory at alternative location either in Perak or Johor. All transportation cost and production cost by locations has shown in **Table 2**. Using Transportation Method, determine:

(i)   Optimum total cost, if Perak is the preferred location for the new factory.

(7 marks)

(ii)   Optimum total cost, if Johor is the preferred location for the new factory.

(7 marks)

(iii)   By comparing the optimum total cost between Perak and Johor, which is the better location to be selected?

(1 marks)

Q2   (a)   List down **four (4)** working conditions that need to be considered for work measurement study.

(4 marks)

(b)   Explain the work measurement terminology below:

(i)   Work Study

(2 marks)

(ii)   Motion Study

(2 marks)

(c)   Work sampling studies were conducted for 5 consecutive days at a radio assembly factory. A total of 50 observations were made during the 8 hours working period for each day as shown in **Table 3**. The number of units managed to be produced are 3,000 units per week. The factory is operating 5 days a week considering with rating and allowance given by 98% and 10%. Compute the assembly process standard time in (min/unit).

(3 marks)

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(d) A work sampling study conducted in a metal coating plant has resulted in the data in **Table 4**. The plant operation time is 8 hours/day, 5 days/week, 4 weeks/month.

  (i) Compute the standard time in (min/unit) for the coating process.

  (3 marks)

  (ii) Determine the overtime period per day that must be arranged to meet the customers demand if the total demand for the plant is 14,000 units per month and only 75% employees are willing to work overtime per every working day.

  (9 marks)

Q3 (a) List down **four (4)** reasons of quality requirement in industries.

  (4 marks)

  (b) Describe the quality control terminology below:

  (i) Deming "Basic Message".

  (3 marks)

  (ii) Control Chart

  (3 marks)

  (c) Data in **Table 5** shows a 20 sub-group of shaft diameter with n = 4, taken from turning process.

  (i) Compute and complete the **Table 5**.

  (2 marks)

  (ii) Prepare the X-bar chart and R chart for this process. Refer to **Table 6** and use **Figure Q3(c)(i)** and **Figure Q3(c)(ii)** to answer the questions.

  (13 marks)

Q4 (a) List down **four (4)** steps of forecasting process.

  (4 marks)

  (b) Explain in detail the "Product Structure" in capacity planning.

  (6 marks)

  (c) Forecasting is the method of anticipating customer future demand in order product to be supplied. According to **Table 7,** calculate:

  (i) Forecasting unit of TV set for the month October by using "Simple exponential smoothing" method with α = 0.3. Assume the forecast for month of July is 2,000 units.

  (5 marks)

(ii)   The number of bracket required in order to meet a forecasting value at question (i) above. Refer to **Figure Q4(c)** Product Structure to answer a questions.

(5 marks)

(iii)   The bracket's raw material need to be purchased, three type of machines required to fabricated the bracket. The scrap rate for 1st machine is 4%, 2nd machine is 3% and 3rd machine is 2.5%.

(5 marks)

Q5   (a)   Define inventory cost terminology below:

(i)   Ordering Cost

(2 marks)

(ii)   Setup Cost

(2 marks)

(b)   Sonic Computer Company uses 1,000 transistors each month for its computers assembly. The unit cost of each transistor is $10, and the cost of holding one transistor in inventory for a year is $3. Ordering cost is $30 per order. The company operates 200 working days per year. Identify:

(i)   The optimal order quantity

(2 marks)

(ii)   The expected number of orders placed each year

(2 marks)

(iii)   The expected time between orders

(2 marks)

(c)   **Table 8** indicate jobs sequence at ABC Company. Prepare **Table 9** completely with your correct answer. Each answer must be support by calculation.
Note:
FCFS: First Come, First Served,
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SPT: Shortest Processing Time

(15 marks)

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Q6 (a) List down *four (4)* types of "waste" in lean production.

(4 marks)

(b) Explain *three (3)* purpose of Just-in-Time (JIT) implementation in lean production.

(6 marks)

(c) *Figure Q6* shows product structure for product A1. Data of customer demands and inventory status for all items are shown in *Table 10* and *Table 11*. Prepare a material requirement planning (MRP) for item G with FOQ=300 and safety stock=90. Fill in related information in *Table 12* and attach it along with your answer script.

(15 marks)

- END OF QUESTION -

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Jadual 1/Table 1: Existing factory capacity per month and total monthly demand

Existing Factory	Monthly Capacity	Total Monthly Demand of Proton Factory
Selangor	10,000	
Melaka	7,000	35,000
P.Pinang	10,000	

Jadual 2/Table 2: Transportation Cost and Production Cost by Locations

From\To	Kuala Lumpur (RM)	Kedah (RM)	Johor (RM)	N.Sembilan (RM)	Pahang (RM)	Monthly Capacity	Production Cost (RM)
Selangor	4	20	15	9	12.50	10,000	50
Melaka	10	30	9	5	15.50	7,000	55
P.Pinang	17.50	7	37.50	30	15	10,000	48
Perak	12.50	10	30	22.50	14.50	8,000	50
Johor	15.50	35	2	11.50	17.60	8,000	50
Monthly Demand of Proton Factory by Location	**11,000**	**5,000**	**9,000**	**7,000**	**3,000**		

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Jadual 3/Table 3: 5-Day work sampling study data

Status	Tally	Sum
Productive	IIIII IIIII IIIII IIIII IIIII IIIII IIIII IIIII IIIII I	46
Idle	IIII	4

Jadual 4/Table 4: Work Sampling Studies Data

Item	Data
Total observation period	5 days
Observation time per day	8 hours
Plant in operations during 5-day study	300 observations
Plant idle during 5-day study	6 observations
Average daily output	550 units/day
Rating	90%
Allowances	15%

Jadual 5/Table 5: Shaft Diameter

Sub Group	Shaft Diameter (mm)					
	X_1	X_2	X_3	X_4	X-bar	R
1	21	31	22	39		
2	32	20	38	35		
3	21	37	21	25		
4	20	26	30	30		
5	21	28	33	32		
6	38	41	39	41		
7	38	35	38	30		
8	29	32	36	29		
9	38	38	39	39		
10	35	36	25	28		
11	37	32	25	30		
12	34	30	29	37		
13	39	38	40	39		
14	29	33	30	31		
15	34	20	31	26		
16	25	26	38	15		
17	36	35	20	24		
18	33	21	22	22		
19	28	35	38	40		
20	36	36	25	25		
				TOTAL =		

*Note: For Simplicity in recording, individual Diameter are coded from 10.00mm

Fill in above table and attached together with your answer script.

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Jadual 6/Table 6

Factors for Computing Central Lines and 3σ Control Limits for $\bar{\bar{X}}$, s and R Charts.

OBSERVATIONS IN SAMPLE, n	CHART FOR AVERAGES FACTORS FOR CONTROL LIMITS			CHART FOR STANDARD DEVIATIONS FACTOR FOR CENTRAL LINE	FACTORS FOR CONTROL LIMITS				CHART FOR RANGES FACTOR FOR CENTRAL LINE	FACTORS FOR CONTROL LIMITS				
	A	A_2	A_3	c_4	B_3	B_4	B_5	B_6	d_2	d_1	D_1	D_2	D_3	D_4
2	2.121	1.880	2.659	0.7979	0	3.267	0	2.606	1.128	0.853	0	3.686	0	3.267
3	1.732	1.023	1.954	0.8862	0	2.568	0	2.276	1.693	0.888	0	4.358	0	2.574
4	1.500	0.729	1.628	0.9213	0	2.266	0	2.088	2.059	0.880	0	4.698	0	2.282
5	1.342	0.577	1.427	0.9400	0	2.089	0	1.964	2.326	0.864	0	4.918	0	2.114
6	1.225	0.483	1.287	0.9515	0.030	1.970	0.029	1.874	2.534	0.848	0	5.078	0	2.004
7	1.134	0.419	1.182	0.9594	0.118	1.882	0.113	1.806	2.704	0.833	0.204	5.204	0.076	1.924
8	1.061	0.373	1.099	0.9650	0.185	1.815	0.179	1.751	2.847	0.820	0.388	5.306	0.136	1.864
9	1.000	0.337	1.032	0.9693	0.239	1.761	0.232	1.707	2.970	0.808	0.547	5.393	0.184	1.816
10	0.949	0.308	0.975	0.9727	0.284	1.716	0.276	1.669	3.078	0.797	0.687	5.469	0.223	1.777
11	0.905	0.285	0.927	0.9754	0.321	1.679	0.313	1.637	3.173	0.787	0.811	5.535	0.256	1.744
12	0.866	0.266	0.886	0.9776	0.354	1.646	0.346	1.610	3.258	0.778	0.922	5.594	0.283	1.717
13	0.832	0.249	0.850	0.9794	0.382	1.618	0.374	1.585	3.336	0.770	1.025	5.647	0.307	1.693
14	0.802	0.235	0.817	0.9810	0.406	1.594	0.399	1.563	3.407	0.763	1.118	5.696	0.328	1.672
15	0.775	0.223	0.789	0.9823	0.428	1.572	0.421	1.544	3.472	0.756	1.203	5.741	0.347	1.653
16	0.750	0.212	0.763	0.9835	0.448	1.552	0.440	1.526	3.532	0.750	1.282	5.782	0.363	1.637
17	0.728	0.203	0.739	0.9845	0.466	1.534	0.458	1.511	3.588	0.744	1.356	5.820	0.378	1.622
18	0.707	0.194	0.718	0.9854	0.482	1.518	0.475	1.496	3.640	0.739	1.424	5.856	0.391	1.608
19	0.688	0.187	0.698	0.9862	0.497	1.503	0.490	1.483	3.689	0.734	1.487	5.891	0.403	1.597
20	0.671	0.180	0.680	0.9869	0.510	1.490	0.504	1.470	3.735	0.729	1.549	5.921	0.415	1.585

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X-BAR CHART

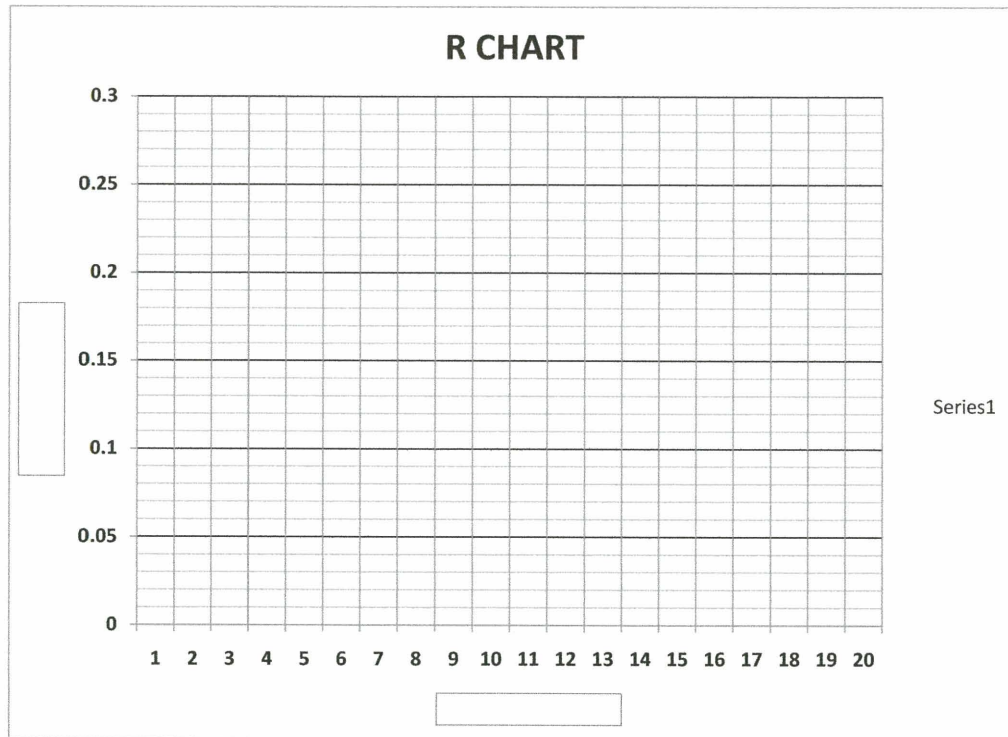| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |

(y-axis: 10.15, 10.20, 10.25, 10.30, 10.35, 10.40, 10.45)

Series1
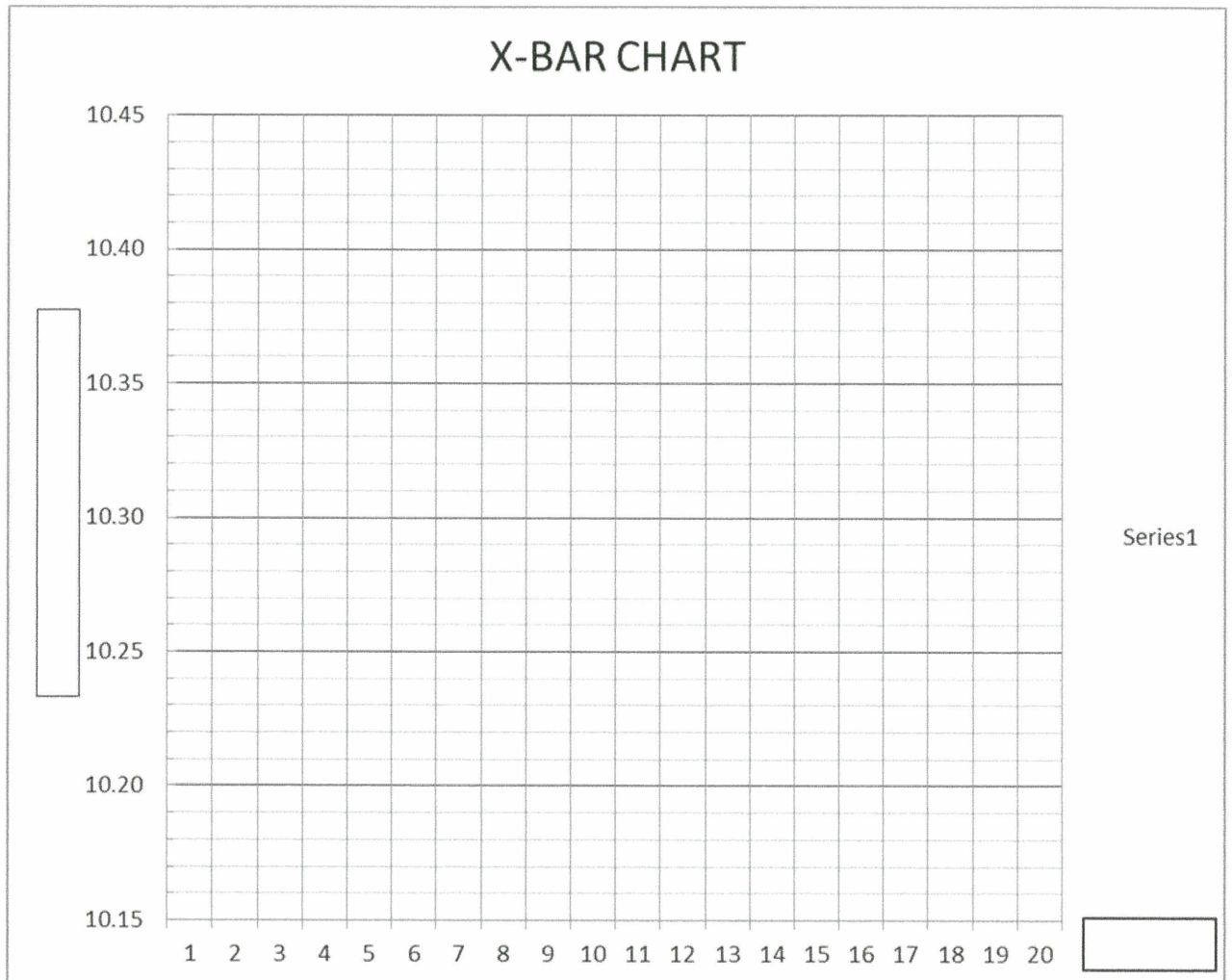
Rajah S3(c)(i)/Figure Q3(c)(i): X-Bar Chart

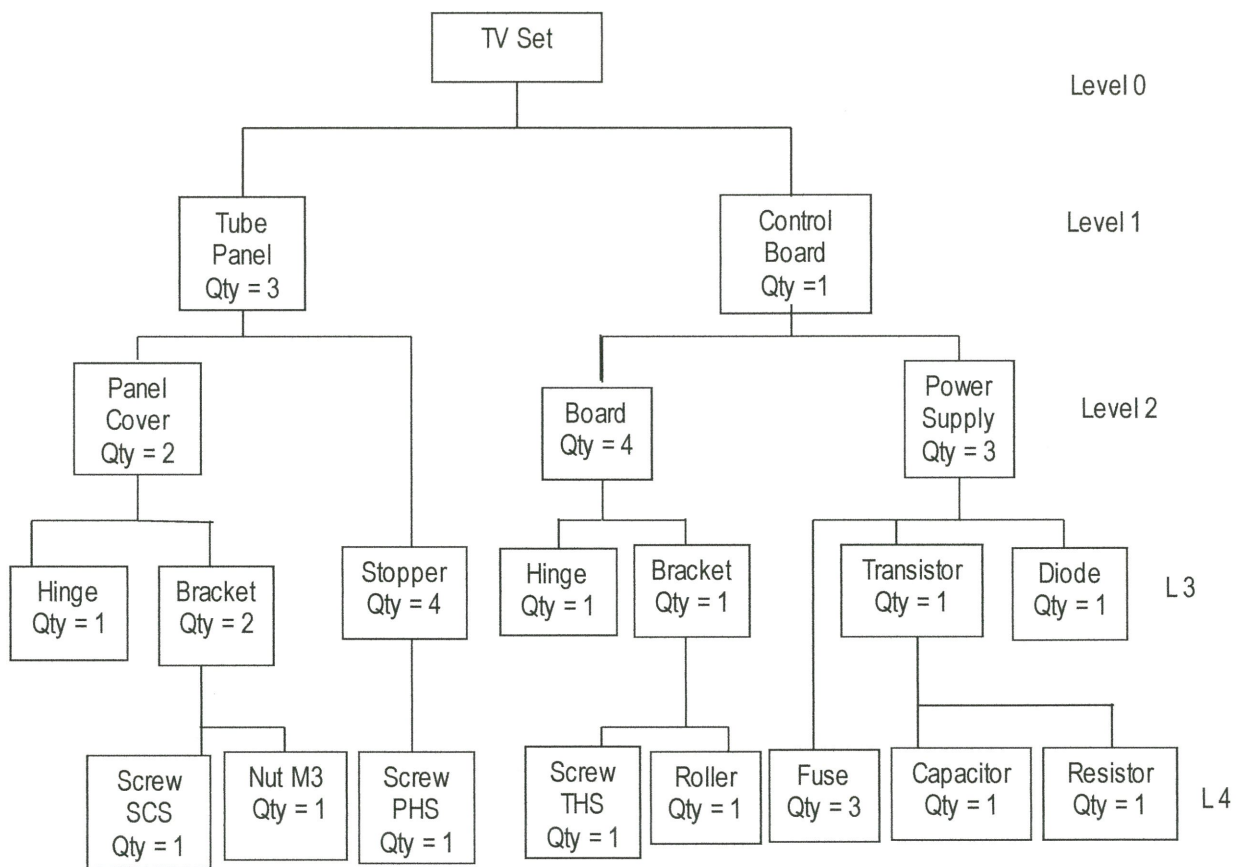*# Fill in above chart and attached together with your answer script.*

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R CHART

Rajah S3(c)(ii)/Figure Q3(c)(ii): R Chart

 # Fill in above chart and attached together with your answer script.

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Rajah S4(c): Figure Q4(c): TV Set Product Structure

Jadual 7/Table 7: TV set Actual Demand

Month	Actual Demand
April	1,500
Mei	2,000
Jun	1,800
July	2,200
Aug	2,000
Sep	2,300

Jadual 8/Table 8: Job sequence at ABC Company

Job	Job work (processing) time (Days)	Job Due Date
A	5	7
B	1	5
C	7	17
D	2	14
E	8	22

Jadual 9/Table 9: Sequencing Data collection

Rule	Average Completion Time	Average Tardiness	No. of Jobs Tardy	Maximum Tardiness
FCFS				
DDATE				
SPT				

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Jadual 10/Table 10: Customer demand of product A1

Weeks	3	4	5	6	7	8
Demand			76	87		115

Jadual 11/Table 11: Inventory status for all items

Item	Rule	Lead Time (week)	On-hand inventory	Item	Rule	Lead Time (week)	On-hand inventory
B1	FOQ=50	2	30	E	FOQ=50	1	0
B2	POQ (P=2)	1	30	F	L4L	1	0
B3	FOQ=50	1	44	G	FOQ=300 safety stock = 90	1	150
C	FOQ=70	3	10	H	FOQ=100	4	7
D	FOQ=50	2	11	A1	L4L	1	0
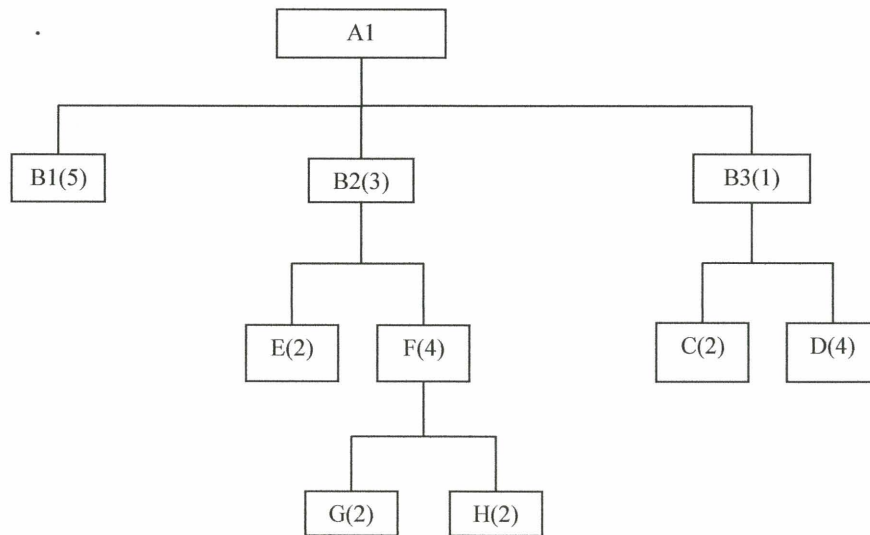
Rajah S6/Figure Q6: Product Structure of Product A1

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Jadual 12/Table 12: Material Requirement Planning for item G

Item:						Lot Size: Lead Time:		
	Week							
	1	2	3	4	5	6	7	8
Gross Requirements								
Scheduled Receipts								
Projected-on-hand inventory								
Planned Receipts								
Planned Order Releases								

Item:						Lot Size: Lead Time:		
	Week							
	1	2	3	4	5	6	7	8
Gross Requirements								
Scheduled Receipts								
Projected-on-hand inventory								
Planned Receipts								
Planned Order Releases								

Item:						Lot Size: Lead Time:		
	Week							
	1	2	3	4	5	6	7	8
Gross Requirements								
Scheduled Receipts								
Projected-on-hand inventory								
Planned Receipts								
Planned Order Releases								

Item:						Lot Size: Lead Time:		
	Week							
	1	2	3	4	5	6	7	8
Gross Requirements								
Scheduled Receipts								
Projected-on-hand inventory								
Planned Receipts								
Planned Order Releases								

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Formulas:

$$f(x, y) = \sum_{i=1}^{n} w_i \left(\left| x - a_i \right| + \left| y - b_i \right| \right)$$ ⟶   Minisum formula

$$f(x, y) = \max_{1 \le i \le n} \left(\left| x - a_i \right| + \left| y - b_i \right| \right)$$

First point : $(x_i, y_i) = 0.5\,(c_1 - c_3,\ c_1 + c_3 + c_5)$

Second point : $(x_2, y_2) = 0.5\,(c_2 - c_4,\ c_2 + c_4 - c_5)$

⟶ Minimax formula

$$a = \frac{\sum y - b \sum x}{n} \qquad b = \frac{n \sum xy - \sum x \sum y}{n \sum x^2 - \left(\sum x \right)^2}$$ ⟶   Regression formula

$$Q^* = \sqrt{\frac{2DS}{H}} \qquad TC = \frac{D}{Q} S + \frac{Q^*}{2} H$$

$$Q^* = \sqrt{\frac{2DS}{H(1 - d/p)}} \qquad TC = \frac{D}{Q} S + \frac{Q^*}{2} H * (1 - d/p)$$

$$d = \frac{D}{\text{working days / year}}$$

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