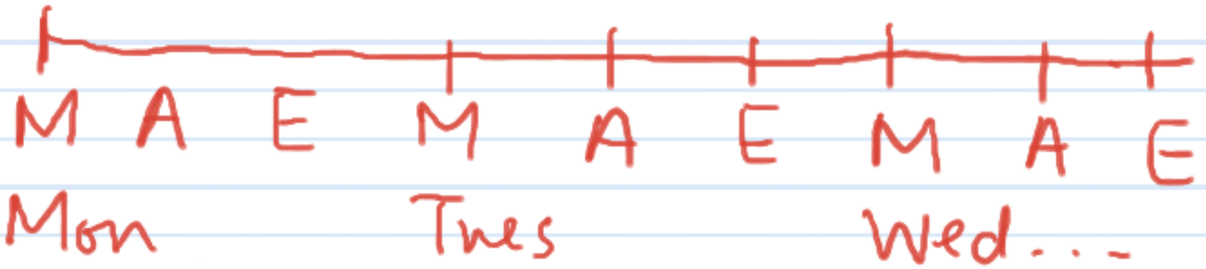
Q1. The following table shows the number of components produced by a factory during the morning, afternoon and evening shifts last week. The factory operates 5 days a week.

Day	Number of components produced		
	Morning Shift	Afternoon Shift	Evening Shift
Monday	127	114	134
Tuesday	130	115	138
Wednesday	128	117	142
Thursday	131	116	141
Friday	132	120	144

(a) Draw a historigram for the above time series data on a graph paper.
(b) Use the method of moving averages to find the trend values.
(c) Calculate an estimate for each shift variation using the additive model.
(d) Compute the number of components produced corrected for shift movements.
(e) Plot the deseasonalised data on the same graph paper.
(f) Forecast the number of components produced during the morning shift of Monday this week.

order



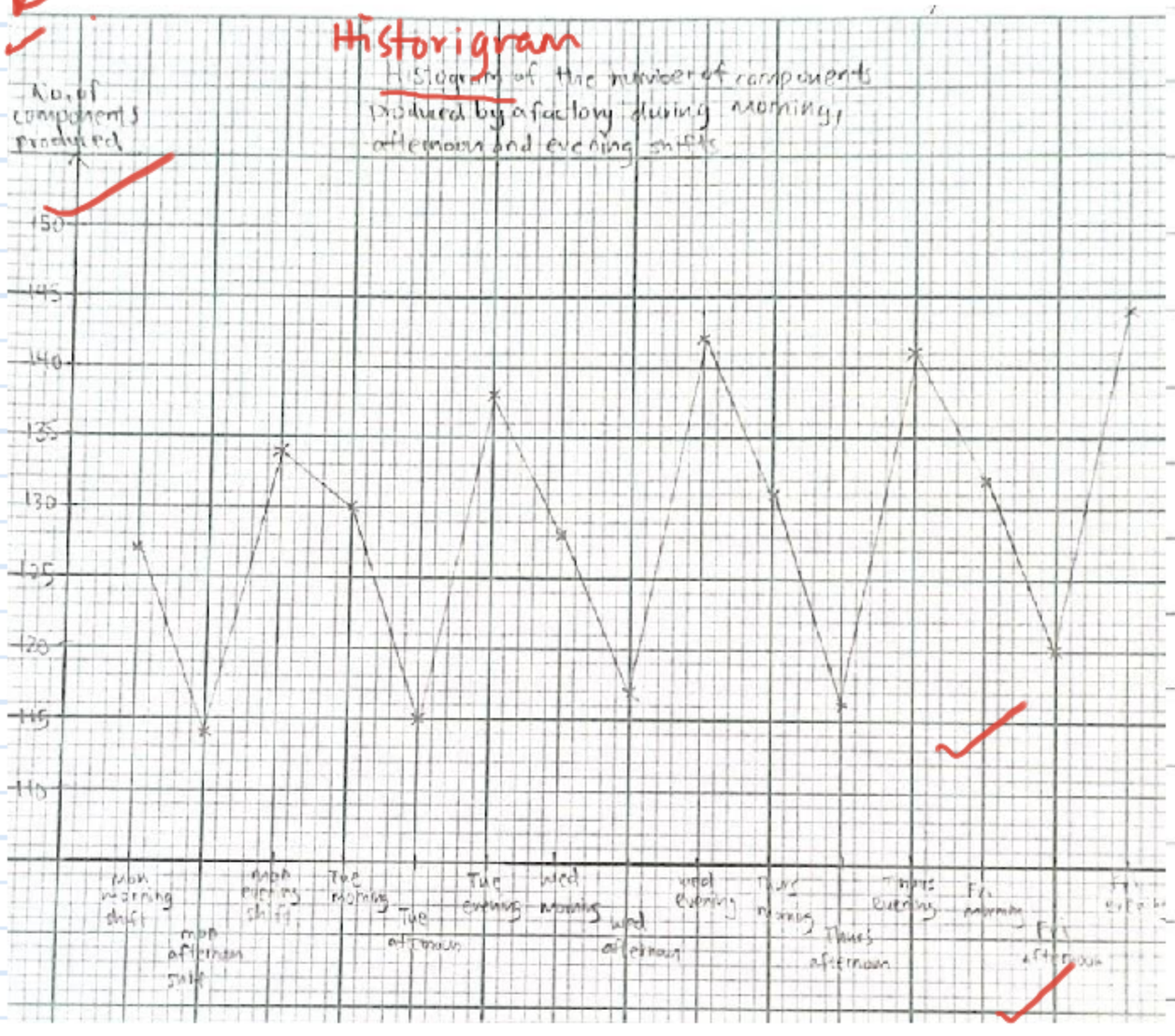
→ adjust according to season (shift
→ deseasonalise the data

season → shift

(a)(b) Aaron ok.

(c)(f) Cecilia ok.

(d)(e) Pui Mun ok.



	shift	output	3-shift MT	3-shift MAT
Mon	morning	127	-	-
	afternoon	114	375	125
	evening	134	378	126
Tue	morning	130	379	126.3333
	afternoon	115	383	127.6667
	evening	138	381	127
Wed	morning	128	383	127.6667
	afternoon	111	387	129
	evening	142	390	130
Thurs	morning	131	389	129.6667
	afternoon	116	388	129.3333
	evening	141	389	129.6667
Fri	morning	132	393	131
	afternoon	120	396	132
	evening	144	-	-

C)

	Morning	Afternoon	Evening
Monday	-	-11	8
Tuesday	3.6667	-12.6667	11
Wednesday	0.3333	-12	12
Thursday	1.3333	-13.3333	11.3333
Friday	1	-12	-
Total	6.3333	-61	42.3333
Average	1.5833	-12.2	10.5833
Adjustment	1.5833+(-12.2)+10.5833=-0.0334 -(-0.0334)/3=0.0111		
Average Shift variation, S	1.5944	-12.1889	10.5944

Y - T

F)

f)

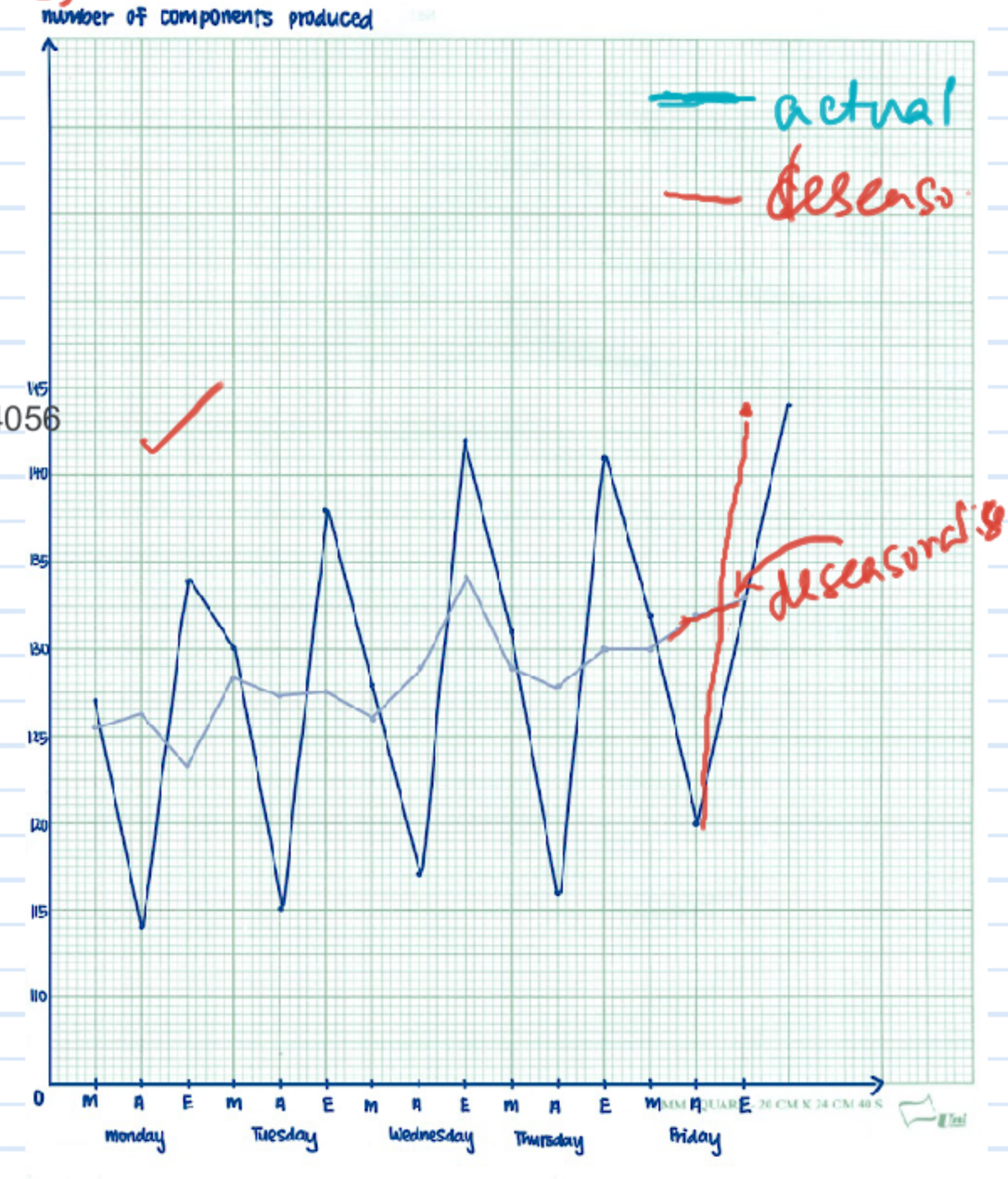
Average change per time period=132-125 / (13-1)=7/12

Shift	Day	Estimated Trend Value	Expected output
Morning	Monday	132+2(7/12)=133.1667	1.5944+133.1667 =134.7611 ~=135

d)

		Number of components produced, Y	Average Daily Variation, S	Deseasonalised data, Y-S
Monday	Morning	127	1.5944	125.4056
	Afternoon	114	-12.1889	126.1889
	Evening	134	10.5944	123.4056
Tuesday	Morning	130	1.5944	128.4056
	Afternoon	115	-12.1889	127.1889
	Evening	138	10.5944	127.4056
Wednesday	Morning	128	1.5944	126.4056
	Afternoon	117	-12.1889	129.1889
	Evening	142	10.5944	~~134.4056~~ 131.4056
Thursday	Morning	131	1.5944	129.4056
	Afternoon	116	-12.1889	128.1889
	Evening	141	10.5944	130.4056
Friday	Morning	132	1.5944	130.4056
	Afternoon	120	-12.1889	132.1889
	Evening	144	10.5944	133.4056

e)



Q2. The unemployed people for each quarter from the year 2008 to year 2010 in a city of a country are given in the table below.

Year	Quarter 1	Quarter 2	Quarter 3	Quarter 4
2008	1408	768	7040	1984
2009	1344	1664	9600	4480
2010	3200	2304	9344	7040

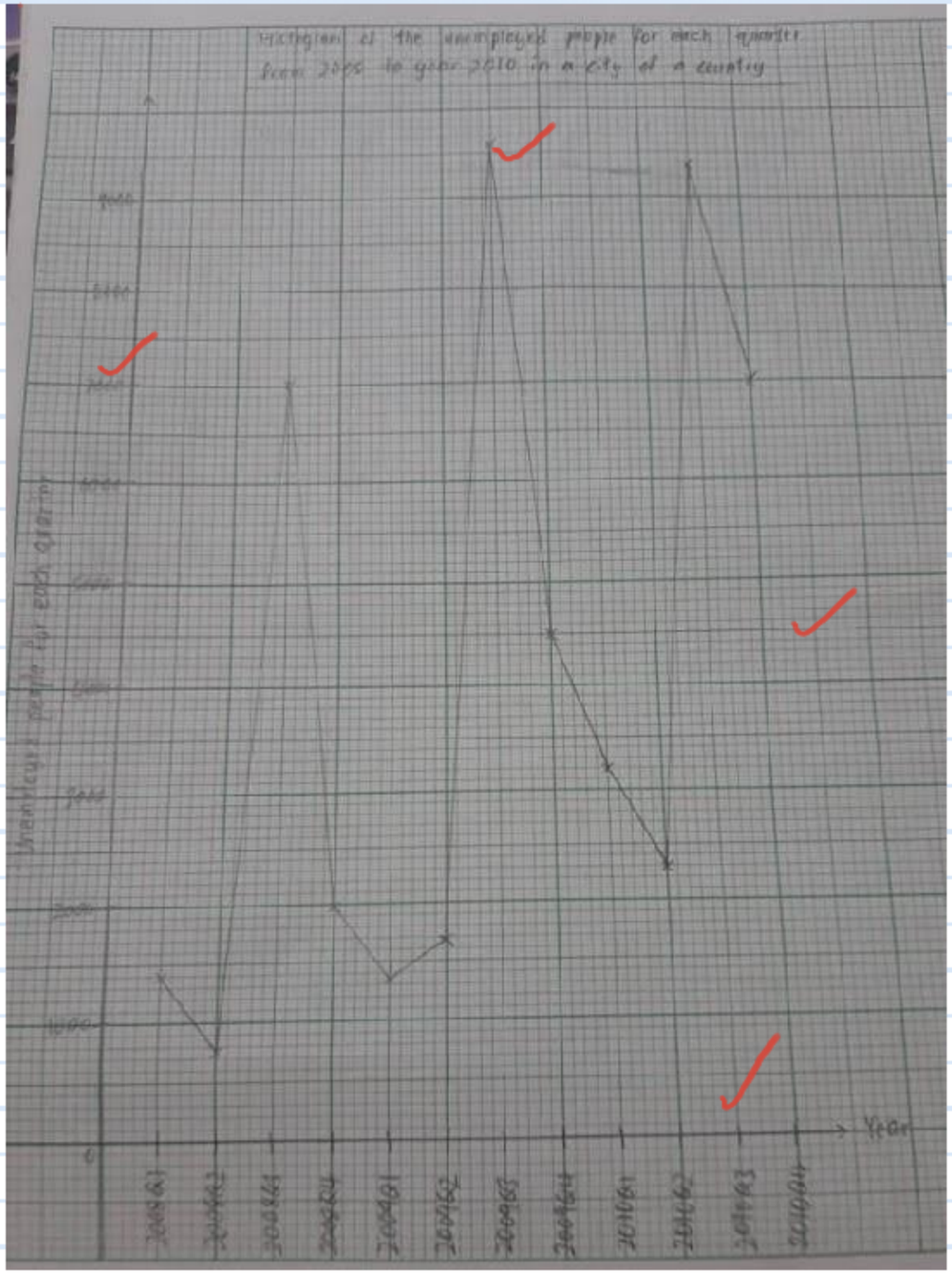
(a) Draw a historigram for the above time series data on a graph paper.
(b) Calculate the trends by means of four-quarter centered moving average.
(c) Assuming an additive model, find the average quarterly variations.
(d) Deseasonalise the above time series data.
(e) Plot the deseasonalised data on the same graph paper.
(f) Forecast the number of unemployed people in that city in the year 2011.

(a)(b) Khai Jun ok

(c)(f) Chun Wai ok

(d)(e) Jing Xian ok

Q1c



Q2b

CMA

Year	Quarter	Unemployed people for each quarter	4-Quarter moving Total	4-Quarter moving average	Trend, T
2005	1	1408			—
	2	768			—
	3	7040	11200	2800	2792
	4	1984	11136	2784	2896
2006	1	1344	12032	3008	3328
	2	1664	14592	3648	3960
	3	9600	17088	4272	4500
	4	4020	18944	4736	4816
2010	1	3200	19584	4896	4864
	2	2304	19328	4832	5152
	3	9340	21888	5472	—
	4	7040			—

(c)(f) Chun Wai

	Quarter 1	Quarter 2	Quarter 3	Quarter 4
2008	-	-	4248	-912
2009	-1984	-2296	5096	-336
2010	-1664	-2848	-	-
Total	-3648	-5144	9344	-1248
Average	-1824	-2572	4672	-624
Adjustment	$-1824+(-2572)+4672+(-624)=-348$ $\frac{-(-348)}{4}=87$			
Average quarterly variations	-1737	-2485	4759	-537

(f)

Mean increment in trend $= \frac{5152-2792}{8-1}$

$= 337.1429$

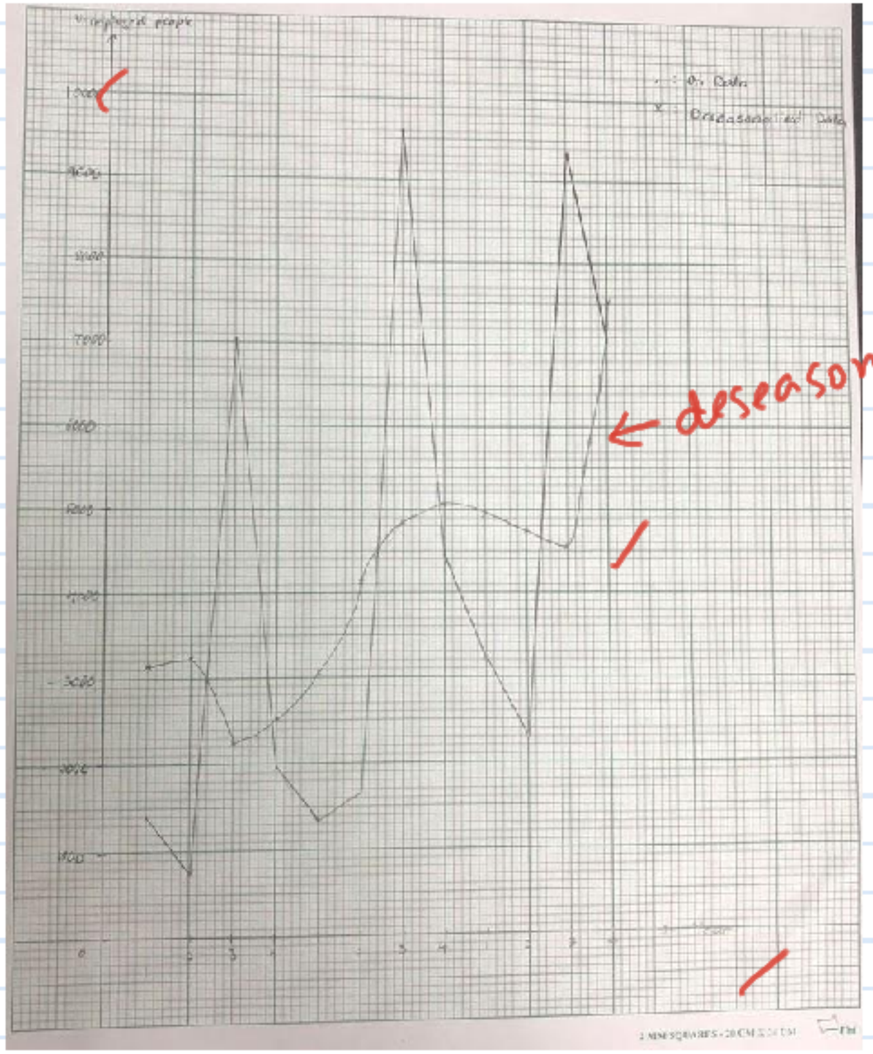
Year	Quarter	No. of trend after last trend	Estimated trend value, T_{est}	Estimated unemployed people, $Y_{est}=T_{est}+S$	
2011	1	3	$5152+3(337.1429)=6163.4287$	$6163.4287+(-1737)\approx 4426$	$=4426.4287\approx 4426$
	2	4	$5152+4(337.1429)=6500.5716$	$6500.5716+(-2485)\approx 4016$	$=$
	3	5	$5152+5(337.1429)=6837.7145$	$6837.7145+4759\approx 11597$	$=$
	4	6	$5152+6(337.1429)=7174.8574$	$7174.8574+(-537)\approx 6638$	$=$

$=$ exact $\approx$ approx / rounding

(d)(e) Jing Xian

2d

Year	Quarter	Y	S	Y - S
2008	1	1408	- 1737	3145
	2	768	-2485	3253
	3	4040	4759	2281
	4	1984	-537	2521
2009	1	1344	-1737	3081
	2	1664	-2485	4149
	3	9600	4759	4841
	4	4480	-537	5017
2010	1	3200	-1737	4937
	2	2304	-2485	4789
	3	9344	4759	4585
	4	7040	-537	7577



← deseasonalised

Q3. The cash sales (in RM) of a store over a three-week period is shown in the table below. The store operates 5 days a week.

Week	Monday	Tuesday	Wednesday	Thursday	Friday
1	306	309	310	306	312
2	302	310	312	305	314
3	308	315	317	317	313

(a) Smooth the time series by means of five-point moving averages.
(b) Using the additive model, calculate the average daily variations.
(c) Deseasonalise the cash sales for Week 2.
(d) Forecast the cash sales for the first three days of Week 4.

(a)(b) Jia Jie

(c)(d) Jing Jet

Week	Day	Output, Y	5 Day Total	Trend, T	Deviation from Trend, Y - T
Week 1	1	306			
	2	309			
	3	310	1543	308.6	1.4
	4	306	1539	307.8	-1.8
	5	312	1540	308	4
Week 2	1	302	1542	308.4	-6.4
	2	310	1541	308.2	1.8
	3	312	1543	308.6	3.4
	4	305	1549	309.8	-4.8
	5	314	1554	310.8	3.2
Week 3	1	308	1559	311.8	-3.8
	2	315	1571	314.2	0.8
	3	317	1570	314	3
	4	317			
	5	313			

			1.4	-1.8	4	
	-6.4	1.8	3.4	-4.8	3.2	
	-3.8	0.8	3			
Total	-10.2000	2.6000	7.8000	-6.6000	7.2000	
	2.0000	2.6000	3.9000	2.6000	2.4000	Total V
Average	-5.1000	1.3000	2.6000	-3.3000	3.6000	-0.9000
Season =	5	Adjustment =	0.1800			Checking V = 0
Average Daily S	-4.9200	1.4800	2.7800	-3.1200	3.7800	0.0000

Date:

USE.

3. c)

		Output	Average Daily Variation, S	Deseasonalised data, Y-S
Week 2	Monday	302	-4.92	306.92
	Tuesday	310	1.48	308.52
	Wednesday	312	2.78	309.22
	Thursday	305	-3.12	308.12
	Friday	314	3.78	310.22

d)

Week	Day	No. of trend	Estimated trend value, Test	Expected output, Yest = Test + S
4	Mon	3	314 + 3 (0.54) = 315.62	315.62 + (-4.92) = RM 310.70
	Tues	4	314 + 4 (0.54) = 316.16	316.16 + 1.48 = RM 317.64
	Wed	5	314 + 5 (0.54) = 316.7	316.7 + 2.78 = RM 319.48

Mean increment in trend = $\frac{314 - 308.6}{11 - 1}$

= 0.54

Q4. The following table shows the total quarterly export (in RM1,000,000) of a company.

Year	Quarter 1	Quarter 2	Quarter 3	Quarter 4
2008	2.7	4.1	3.9	3.1
2009	3.8	5.4	5.3	4.1
2010	4.9	6.8	6.6	5.0
2011	5.9	8.3	-	-

(a) Draw a historigram for the above time series data on a graph paper.
(b) Use the method of moving averages to find the trend values.
(c) Calculate the average quarterly variations using the multiplicative model.
(d) Deseasonalise the above time series data.
(e) Plot the deseasonalised data on the same graph paper.
(f) Forecast the total quarterly export of the company for quarters 3 and 4 of the year 2011.

(a)(b) Jun Yan OK.

(c)(f) Yee Hao OK.

(d)(e) Eason OK.

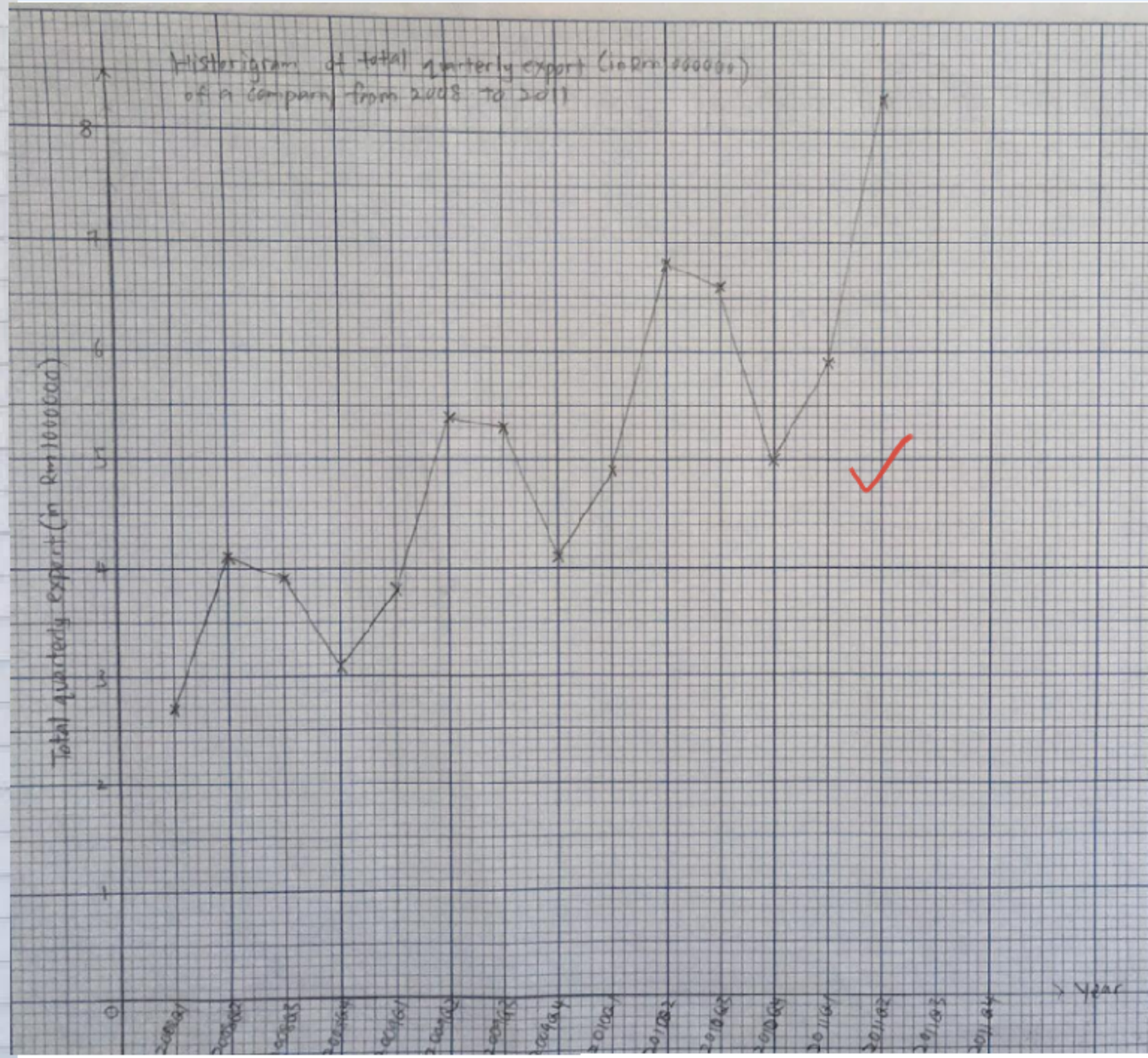
(a)(b)
Jun Yan
ok.

no of season = 4 (even)

(Q4b)

CMA

Year	Quarter	total quarterly export	4-quarter moving total	4-quarter moving average	Trend, T
2008	1	2.7			—
	2	4.1			—
	3	3.9	13.8	3.450	3.5875
	4	3.1	14.9	3.725	3.8875
2009	1	3.8	16.2	4.050	4.2250
	2	5.4	17.6	4.400	4.5250
	3	5.3	18.6	4.650	4.7875
	4	4.1	19.7	4.925	5.1000
2010	1	4.9	21.1	5.275	5.4375
	2	6.8	22.4	5.600	5.7125
	3	6.6	23.3	5.825	5.9500
	4	5.0	24.3	6.075	6.2625
2011	1	5.9	25.8	6.450	—
	2	8.3			—
	3	—			—
	4	—			—



(c)(f) Yee Hao

OK.

	Quarter 1	Quarter 2	Quarter 3	Quarter 4
2008	-	-	1.0871	0.7974
2009	0.8994	1.1934	1.107	0.8039
2010	0.9011	1.1904	1.1092	0.7984
2011	-	-	-	-
Total	1.8005	2.3838	3.3033	2.3997
Average	0.90025	1.1919	1.1011	0.7999
Adjustment	$\frac{4}{3.993154} = 1.0017$			
Seasonal Variation, S	0.9018	1.1939	1.1030	0.8013

Y/T

Average change per time period = $\frac{6.2625 - 3.5875}{10 - 1} = 0.2972$

Year	Quarter	No. of trend after last trend	T_{est}	S	$Y_{est} = T_{est} \times S$
2011	3	3	7.1541	1.103	7.8910 (RM'000 000)
	4	4	7.4513	0.8013	5.9707 (RM '000 000)

(d)(e) Eason

Year	Quarter	Export(Y)	S	Y/S
2008	1	2.7	0.9018	2.9946
	2	4.1	1.1939	3.4341
	3	3.9	1.103	3.5358
	4	3.1	0.8013	3.8687
2009	1	3.8	0.9018	4.2138
	2	5.4	1.1939	4.5230
	3	5.3	1.103	4.8051
	4	4.1	0.8013	5.1167
2010	1	4.9	0.9018	5.4336
	2	6.8	1.1939	5.6956
	3	6.6	1.103	5.9837
	4	5	0.8013	6.2399
2011	1	5.9	0.9018	6.5425
	2	8.3	1.1939	6.9520
	3	-	1.103	-
	4	-	0.8013	-

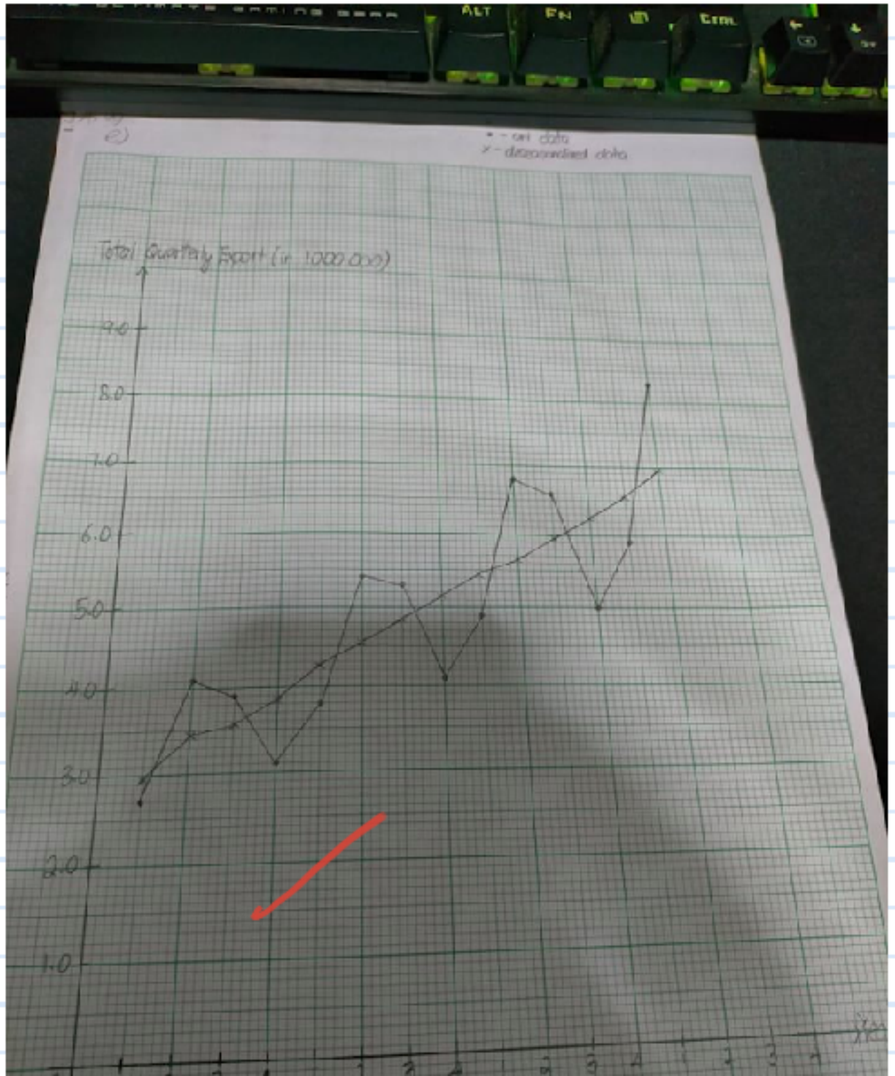
mean increment $= \frac{6.2625 - 3.5875}{10-1}$

$= 0.2972$

Year	Quarter	Number period after last trend	Estimated Trend Value (Test)	S	Expec

. : Ori Data

x : Deseasonalized data



Q5. The following table shows the daily revenues (in RM'000) of a department store over a three-week period.

Week	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
1	7.35	6.65	9.24	7.21	12.60	21.70	21.07
2	9.80	8.54	11.83	9.31	16.17	28.07	27.16
3	12.25	10.85	14.84	11.41	19.53	33.53	32.83

(a) Draw a historigram for the above time series data on a graph paper.
(b) Calculate the trend values by using an appropriate moving average.
(c) Assuming the multiplicative model, compute the average daily variations.
(d) Deseasonalise the daily revenues.
(e) Plot the deseasonalised data on the same graph paper.
(f) Forecast the daily revenue of the department store on Monday and Tuesday of week 4.

(a)(b) Shen Hoi OK.

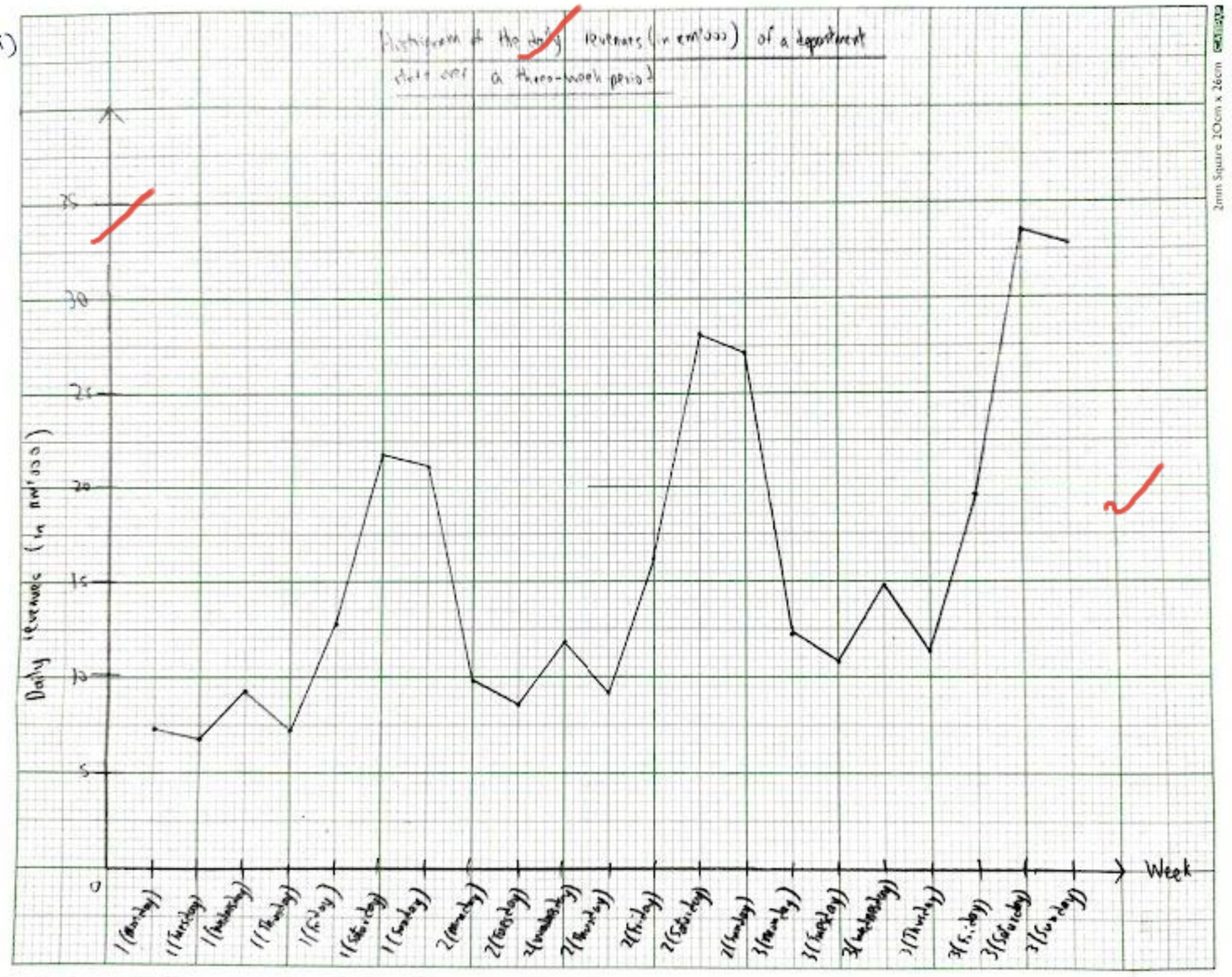
(c)(f) Li Yuet OK.

(d)(e) Kang Hong OK.

Qc.

(a)(b) Shen Hoi

5)(a)



odd number period

b)

Week	Day	Daily revenue	7-quarter moving Total	7-quarter moving Average	Trend, T CMA
1	Monday	7.35		-	
	Tuesday	6.65		-	
	Wednesday	9.74		-	
	Thursday	7.21	85.82	12.26	12.4375
	Friday	12.60	88.27	12.61	12.745
	Saturday	21.70	90.16	12.88	13.065
	Sunday	21.07	92.75	13.25	13.400
2	Monday	9.50	94.85	13.55	13.805
	Tuesday	8.59	98.42	14.06	14.515
	Wednesday	12.83	104.79	14.97	15.405
	Thursday	9.31	112.88	15.84	16.015
	Friday	18.17	113.35	16.19	16.355
	Saturday	28.07	115.64	16.52	18.735
	Sunday	29.16	118.65	16.95	17.700
3	Monday	12.75	120.75	17.25	17.49
	Tuesday	10.55	124.11	17.73	18.12
	Wednesday	14.84	129.57	18.51	17.83
	Thursday	11.41	135.24	19.32	
	Friday	19.53			
	Saturday	32.13			
	Sunday	32.83			

8.5 c)

Week	Mon	Tue	Wed	Thu	Fri	Sat	Sun	
1	–	–	–	0.5881	0.9992	1.6848	1.5902	} Y/T
2	0.7232	0.6074	0.7902	0.5878	0.9988	1.6992	1.6024	
3	0.7107	0.612	0.8017	0.5906	–	–	–	
Total	1.4339	1.2194	1.5919	1.1665	1.998	3.384	3.1926	
Avg	1.7167	0.6097	0.796	0.5888	0.999	1.692	1.5963	6.9985 ≠ 7
Adj	7/6.9985 = 1.000214							
S	0.7169	0.6098	0.7962	0.5889	0.9992	1.6924	1.5966	

Avg daily variations

5f) Mon Increment = $\frac{19.32 - 12.26}{15.1} = 0.5043$

Year	Day	d	Forecast Trend, T	S	Forecast revenue
4	Mon	4	19.32 + 4(0.5043) = 21.3372	0.7169	21.3372 × 0.7109 = 15.2966 (RM000) = RM 15962.60
	Tue	5	19.32 + 5(0.5043) = 21.8415	0.6098	21.8415 × 0.6098 = 13.318 9 (RM 000) = RM 13318.90

to a changes of

$\alpha = 0.4379$

brain weight is 0.4379 (grams) when the

(d)(e) Kang Hong

(d)

Date

Week	Day	Y	S	Y/S
	Monday (M)	7.35	0.7169	10.2525
	Tuesday (Tu)	6.65	0.6098	10.9053
1	Wednesday (W)	9.24	0.7962	11.6051
	Thursday (Th)	7.21	0.5889	12.2432
	Friday (F)	12.60	0.9993	12.6101
	saturday (Sa)	21.72	1.6924	12.8220
	Sunday (Su)	21.07	1.5966	13.1968
	M	9.80	0.7169	13.6700
	Tu	8.54	0.6098	14.0459
2	W	11.83	0.7962	14.8581
	Th	9.31	0.5889	15.8091
	F	16.17	0.9993	16.1829
	Sa	28.07	1.6924	16.5859
	Su	27.16	1.5966	17.0111
	M	12.25	0.7169	17.0875
	Tu	10.85	0.6098	17.7927
3	W	14.84	0.7962	18.6385
	Th	11.41	0.5889	19.3751
	F	19.53	0.9993	19.5456
	Sa	33.53	1.6924	19.8121
	Su	32.83	1.5966	20.5624

14.0046