# UNIVERSITI TUN HUSSEIN ONN MALAYSIA

# FINAL EXAMINATION
# SEMESTER II
# SESSION 2009/2010

| | | |
|---|---|---|
| SUBJECT NAME | : | SIMULATION AND FORECASTING |
| SUBJECT CODE | : | BPB 3163 |
| COURSE | : | 3 BPA |
| EXAMINATION DATE | : | APRIL / MEI 2010 |
| DURATION | : | 3 HOURS |
| INSTRUCTION | : | ANSWER **FIVE (5)** QUESTIONS ONLY OUT OF SEVEN (7) QUESTIONS. |

THIS QUESTION PAPER CONSISTS OF 17 PAGES

Q1 (a) Define what is autocorrelation and explain how to measure autocorrelation coefficient.

(3 marks)

(b) Explain the differences between qualitative forecasting techniques and quantitative techniques.

(4 marks)

(c) Explain the definition of stationary and non stationary in the time series data set.

(3 marks)

(d) Explain the concept of decomposition a time series.

(3 marks)

(e) Explain why there is serial correlation a problem when time series data are analyzed using regression analysis.

(3 marks)

(f) Explain the Box-Jenkins model building strategy.

(4 marks)

Q2 (a) Figure Q2 in Appendix (i) shows the flow diagram for Box-Jenkins model building strategy (source Box *et al.* 1994). Explain briefly what are ***A, B, C*** and ***D***.

(6 marks)

(b) Before using a model for forecasting purposes, the model must be evaluated. State **FOUR (4)** methods or techniques that can be used to evaluate the model.

(4 marks)

(c) There are four major components in time series data analysis.
(i) State and explain all the components.
(ii) Discuss how to overcome each component's problem.

(10 marks)

Q3 Develop a multiple regression model for auto sales as a function of population and household income from the following printed output using SPSS package. Figure Q3(a) and Figure Q3(b) and Table Q3(a) to Table Q3(c) shows the analysis (Appendix ii).

(a) Review the three quick checks that should be used in evaluating a multiple regression.

(5 marks)

(b) Estimate the model and give the physical interpretation.

(3 marks)

(c) Explain whether the signs you find for the coefficient consistent with your expectations.

(3 marks)

(d) Explain whether the coefficients for the two explanatory variables significantly different from zero?

(4 marks)

(e) Determine the percentage of the variation in auto sales is explained by this model?

(1 mark)

(f) Determine the point estimate of auto sales if the city is income = 23,175 and population the city is 128.07?

(2 marks)

(g) Determine what is the approximate 95 percent confidence interval.

(2 marks)

**Q4** Management of a ketchup bottling company wants to develop a method for allocating delivery cost to customers. Although one cost clearly relates to travel time within a particular route, another variable cost reflects the time required to unload the cases for ketchup at the delivery point. A sample of 20 deliveries within a state was selected. The delivery time and the number of cases delivered were recorded.

Based on the SPSS output printed given in Table Q4(a) to Q4(d) in Appendix 3, develop a regression model to predict delivery time base on the number of cases delivered.

(a) Write a regression line and interpret the meaning of the intercept (constant) and slope in this problem.

(3 marks)

(b) Predict the delivery time for 150 cases of ketchup.

(2 marks)

(c) Explain wethere it is appropriate to use the model to predict the delivery time for a customer who is receiving 500 cases.

(3 marks)

(d) Determine the coefficient of determination $R^2$ and explain its meaning in this problem.

(3 marks)

(e) Determine the standard error of the model

(1 marks)

(f) Explain wethere the 0.05 level of significance, is there any evidence of a linear relationship between delivery time and the number of cases delivered.

(4 marks)

(g) Develop the suitable hypothesis to test the model adequacy.

(4 marks)

Q5 (a) Differencing the data is a normal practice in time series analysis.

(i) State the purpose of differencing, *d*.
(ii) Explain why the number of differencing or order is limited to 1 and 2.
(5 marks)

(b) (i) Determine the statistic which can be used to test the autocorrelation in the data set.

(ii) Explain the distribution of the statistics test to test the autocorrelation.
(5 marks)

(c) **Table Q5** in **Appendix IV** shows the prices of crude palm oil (in USD) from January 2003 to December 2004. By using moving average order 2, estimate the crude palm oil prices and calculate the mean absolute error (MAE). Then, use the results to forecast 6 observation a-head i.e. observation 25, 26, 27, 28, 29 and 30.
(10 marks)

Q6 (a) There are several rules or steps in modeling the ARIMA process. State all the rules and explain each rule or step.
(10 marks)

(b) The crude palm oil prices were analyzed using the times series analysis, namely Autoregressive, Moving Average and Autoregressive Integrated Moving Average techniques. The results are shown in **Appendix V**. Base on the results given, answer the following questions;

(i) State all equations of the time series model.
(4 marks)

(ii) Discuss the significant of each model by looking at the *T-ratio* and *Approx. prob*. by stating.
(4 marks)

(iii) Compare the modeling accuracy among the models developed and state your conclusion. (2 marks)

Q7 (a) There are four common problems may occur when analyzing data using the Multiple Linear Regression (MLR).

State all the four problems and give your suggestion to overcome each problem briefly.

(8 marks)

(b) Model building in the MLR always dealing with several number of independent variables. Too many independent variables will cause the model to become more complex and difficult to interpret.

State the methods used to select the statistically significant independent variables in the model.

(4 marks)

(c) Mr. Ahmad is a researcher at Perwira Consultant Sdn. Bhd., wants to know the relationship between the crude palm oil (CPO) prices with other vegetables oil prices such as soybean oil (SBO), coconut oil (CNO), palm kernel oil (PKO), cotton oil (CTO), sunflower oil (SNO) and rapeseed oil (RSO). The analysis was conducted and the outputs are shown in **Table Q7 (a)** to **Q7(e)** and **Figure Q7** in **Appendix VI.**

Consider that the number of observation is 100 and $\alpha = 5\%$. [The Durbin-Watson values at n = 100 and 5% level of significance are $D_L = 1.61$ and $D_U = 1.74$]. Perform some diagnostic analysis according to the problems mentioned in **Q7 (a)**.

(8 marks)

**END OF QUESTION PAPER**

**Appendix I**

PEPERIKSAAN AKHIR

SEMESTER/SESI : SEMESTER II/09/10
MATA PELAJARAN : SIMULASI DAN PERAMALAN

KURSUS: 3 BPA
KOD MATA PELAJARAN: BPB3163

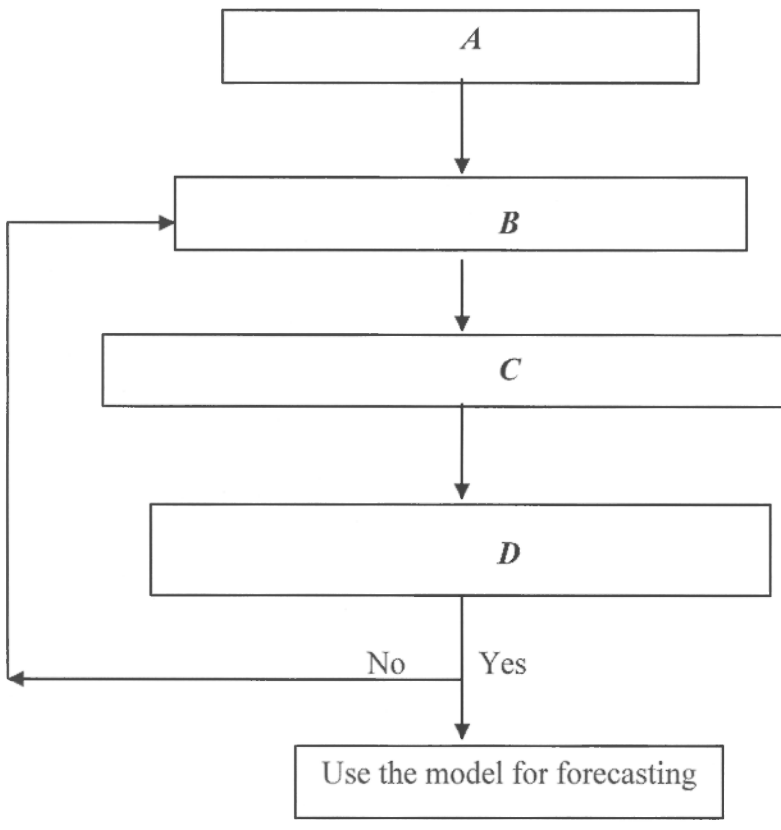


Figure Q2

**Appendix II**

PEPERIKSAAN AKHIR

SEMESTER/SESI : SEMESTER II/09/10
MATA PELAJARAN : SIMULASI DAN PERAMALAN

KURSUS: 3 BPA
KOD MATA PELAJARAN: BPB3163

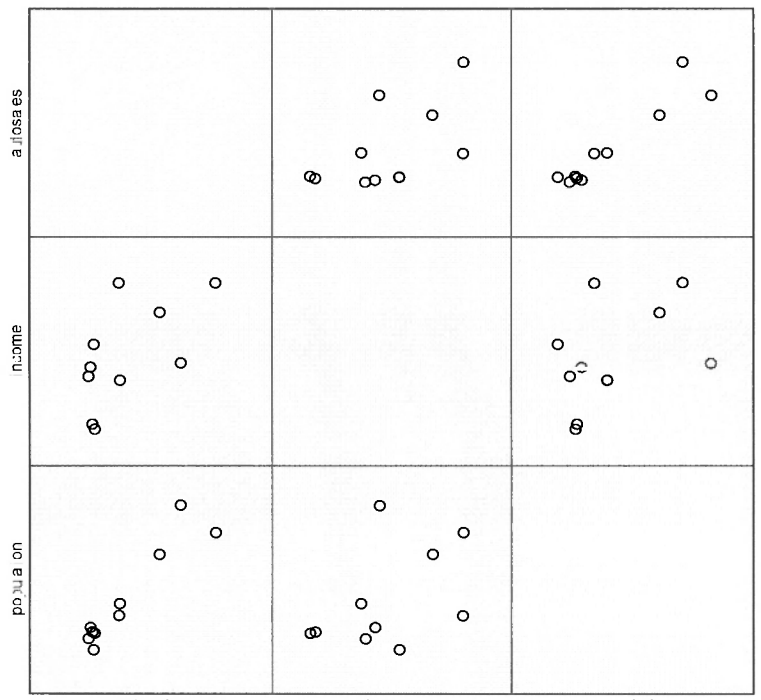


Figure Q3(a). Scatter plot for auto sales, house hold income and population

Table Q3(a). Model summary

**Model Summary[b]**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Durbin-Watson |
|---|---|---|---|---|---|
| 1 | .940[a] | .885 | .870 | 57050.41359 | 2.892 |

a. Predictors: (Constant), population

b. Dependent Variable: autosales

## Appendix II

Table Q3(b). Analysis of variance

**ANOVA** [b]

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 2E+011 | 1 | 1.994E+011 | 61.273 | .000[a] |
| | Residual | 3E+010 | 8 | 3254749691 | | |
| | Total | 2E+011 | 9 | | | |

a. Predictors: (Constant), population

b. Dependent Variable: autosales

Table Q3(c). Coefficient estimate

**Coefficients**[a]

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | 95% Confidence Interval for B | |
|---|---|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | | Lower Bound | Upper Bound |
| 1 | (Constant) | -48821.6 | 37543.410 | | -1.300 | .230 | -135396.886 | 37753.629 |
| | population | 1573.844 | 201.060 | .940 | 7.828 | .000 | 1110.198 | 2037.490 |

a. Dependent Variable: autosales

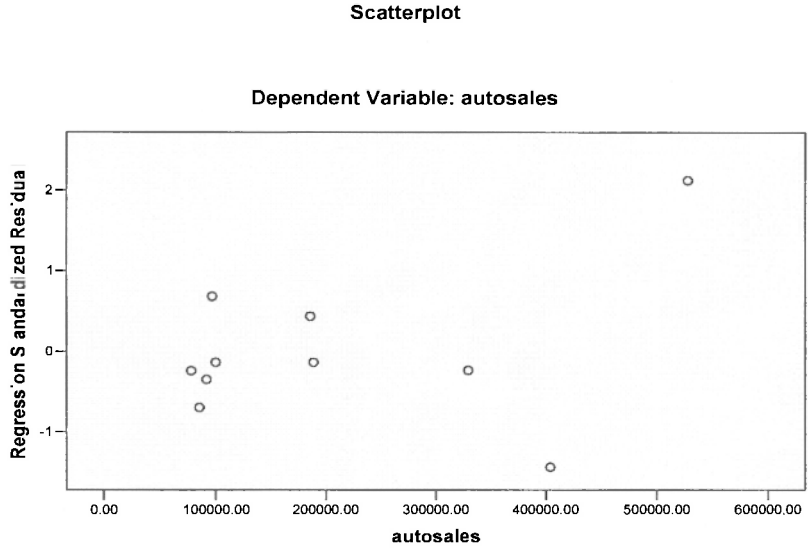


Figure Q3(b). Residual plot

**Appendix III**

PEPERIKSAAN AKHIR

SEMESTER/SESI : SEMESTER II/05/06
MATA PELAJARAN : SIMULASI DAN PERAMALAN

KURSUS: 3 BPA
KOD MATA PELAJARAN: BPB3163

Table Q4(a)

| Customer | No. of cases | Delivery time (minutes) | Customer | No. of cases | Delivery time (minutes) |
|---|---|---|---|---|---|
| 1 | 52 | 32.1 | 11 | 161 | 43.0 |
| 2 | 64 | 34.8 | 12 | 184 | 49.4 |
| 3 | 73 | 36.2 | 13 | 202 | 57.2 |
| 4 | 85 | 37.8 | 14 | 218 | 56.8 |
| 5 | 95 | 37.8 | 15 | 243 | 60.6 |
| 6 | 103 | 39.7 | 16 | 254 | 61.2 |
| 7 | 116 | 38.5 | 17 | 267 | 58.2 |
| 8 | 121 | 41.9 | 18 | 275 | 63.1 |
| 9 | 143 | 44.2 | 19 | 287 | 65.6 |
| 10 | 157 | 47.1 | 20 | 298 | 67.3 |

Table Q4(b)

**Model Summary[b]**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Durbin-Watson |
|---|---|---|---|---|---|
| 1 | .918[a] | .842 | .833 | 4.70008 | 2.283 |

a. Predictors: (Constant), CASES

b. Dependent Variable: TIME

Table Q4(c)

**ANOVA[b]**

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 2116.864 | 1 | 2116.864 | 95.826 | .000[a] |
| | Residual | 397.633 | 18 | 22.091 | | |
| | Total | 2514.498 | 19 | | | |

a. Predictors: (Constant), CASES

b. Dependent Variable: TIME

**Appendix III**

PEPERIKSAAN AKHIR

SEMESTER/SESI : SEMESTER II/05/06
MATA PELAJARAN : SIMULASI DAN PERAMALAN

KURSUS: 3 BPA
KOD MATA PELAJARAN: BPB3163

Table Q4(d)

**Coefficients[a]**

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | 95% Confidence Interval for B | |
|---|---|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | | Lower Bound | Upper Bound |
| 1 | (Constant) | 29.118 | 2.253 | | 12.925 | .000 | 24.385 | 33.851 |
| | CASES | .120 | .012 | .918 | 9.789 | .000 | .094 | .146 |

a. Dependent Variable: TIME

**Appendix IV**

PEPERIKSAAN AKHIR

SEMESTER/SESI : SEMESTER II/09/10 KURSUS: 3 BPA
MATA PELAJARAN : SIMULASI DAN PERAMALAN KOD MATA PELAJARAN: BPB3163

Table Q5

| Month | Crude Palm Oil Prices (USD) |
|---|---|
| 1 | 458 |
| 2 | 452 |
| 3 | 426 |
| 4 | 412 |
| 5 | 417 |
| 6 | 430 |
| 7 | 411 |
| 8 | 395 |
| 9 | 420 |
| 10 | 485 |
| 11 | 503 |
| 12 | 510 |
| 13 | 496 |
| 14 | 535 |
| 15 | 550 |
| 16 | 538 |
| 17 | 518 |
| 18 | 440 |
| 19 | 426 |
| 20 | 432 |
| 21 | 439 |
| 22 | 431 |
| 23 | 433 |
| 24 | 423 |

**Appendix V**

PEPERIKSAAN AKHIR

SEMESTER/SESI : SEMESTER II/09/10
MATA PELAJARAN : SIMULASI DAN PERAMALAN

KURSUS: 3 BPA
KOD MATA PELAJARAN: BPB3163

Residual Diagnostics

| | |
|---|---|
| Number of Residuals | 263 |
| Number of Parameters | 2 |
| Residual df | 260 |
| Adjusted Residual Sum of Squares | 348129.753 |
| Residual Sum of Squares | 348131.038 |
| Residual Variance | 1337.900 |
| Model Std. Error | 36.577 |
| Log-Likelihood | -1218.434 |
| Akaike's Information Criterion (AIC) | 2442.867 |
| Schwarz's Bayesian Criterion (BIC) | 2453.583 |

Parameter Estimates

| | | Estimates | Std Error | t | Approx Sig |
|---|---|---|---|---|---|
| Non-Seasonal Lags | AR1 | .301 | .060 | 5.047 | .000 |
| | AR2 | -.269 | .060 | -4.509 | .000 |
| Constant | | .179 | 2.333 | .077 | .939 |

Melard's algorithm was used for estimation.

Residual Diagnostics

| | |
|---|---|
| Number of Residuals | 263 |
| Number of Parameters | 2 |
| Residual df | 260 |
| Adjusted Residual Sum of Squares | 353072.097 |
| Residual Sum of Squares | 361809.404 |
| Residual Variance | 1357.177 |
| Model Std. Error | 36.840 |
| Log-Likelihood | -1320.288 |
| Akaike's Information Criterion (AIC) | 2646.575 |
| Schwarz's Bayesian Criterion (BIC) | 2657.292 |

Parameter Estimates

| | | Estimates | Std Error | t | Approx Sig |
|---|---|---|---|---|---|
| Non-Seasonal Lags | MA1 | -.301 | .062 | -4.891 | .000 |
| | MA2 | .120 | .062 | 1.944 | .053 |
| Constant | | .178 | 2.683 | .066 | .947 |

Melard's algorithm was used for estimation.

**Appendix V**

PEPERIKSAAN AKHIR

SEMESTER/SESI : SEMESTER II/09/10
MATA PELAJARAN : SIMULASI DAN PERAMALAN

KURSUS: 3 BPA
KOD MATA PELAJARAN: BPB3163

Residual Diagnostics

| | |
|---|---|
| Number of Residuals | 263 |
| Number of Parameters | 2 |
| Residual df | 260 |
| Adjusted Residual Sum of Squares | 355711.366 |
| Residual Sum of Squares | 403405.685 |
| Residual Variance | 1367.343 |
| Model Std. Error | 36.978 |
| Log-Likelihood | -1221.267 |
| Akaike's Information Criterion (AIC) | 2548.534 |
| Schwarz's Bayesian Criterion (BIC) | 2559.250 |

Parameter Estimates

| | | Estimates | Std Error | t | Approx Sig |
|---|---|---|---|---|---|
| Non-Seasonal Lags | AR1 | -.176 | .164 | -1.073 | .284 |
| | MA1 | -.515 | .143 | -3.599 | .000 |
| Constant | | .174 | 2.935 | .059 | .953 |

Melard's algorithm was used for estimation.

**Appendix VI**

PEPERIKSAAN AKHIR

SEMESTER/SESI : SEMESTER II/09/10
MATA PELAJARAN : SIMULASI DAN PERAMALAN

KURSUS: 3 BPA
KOD MATA PELAJARAN: BPB3163

Table Q7(a)

**Model Summary[d]**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Durbin-Watson |
|---|---|---|---|---|---|
| 1 | .872[a] | .761 | .760 | 68.692 | |
| 2 | .925[b] | .855 | .854 | 53.592 | |
| 3 | .926[c] | .858 | .857 | 53.048 | .286 |

a. Predictors: (Constant), SBO

b. Predictors: (Constant), SBO, PKO

c. Predictors: (Constant), SBO, PKO, CTO

d. Dependent Variable: CPO

Table Q7(b)

**ANOVA[d]**

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 3930277 | 1 | 3930277.056 | 832.929 | .000[a] |
| | Residual | 1236279 | 262 | 4718.622 | | |
| | Total | 5166556 | 263 | | | |
| 2 | Regression | 4416951 | 2 | 2208475.588 | 768.955 | .000[b] |
| | Residual | 749604.8 | 261 | 2872.049 | | |
| | Total | 5166556 | 263 | | | |
| 3 | Regression | 4434892 | 3 | 1478297.411 | 525.320 | .000[c] |
| | Residual | 731663.8 | 260 | 2814.091 | | |
| | Total | 5166556 | 263 | | | |

a. Predictors: (Constant), SBO

b. Predictors: (Constant), SBO, PKO

c. Predictors: (Constant), SBO, PKO, CTO

d. Dependent Variable: CPO

**Appendix VI**

PEPERIKSAAN AKHIR

SEMESTER/SESI : SEMESTER II/09/10
MATA PELAJARAN : SIMULASI DAN PERAMALAN

KURSUS: 3 BPA
KOD MATA PELAJARAN: BPB3163

Table Q7(c)

**Casewise Diagnostics[a]**

| Case Number | Std. Residual | CPO | Predicted Value | Residual |
|---|---|---|---|---|
| 71 | 3.511 | 547 | 360.74 | 186.26 |

a. Dependent Variable: CPO

Table Q7(d)

**Coefficients[a]**

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | 5% Confidence Interval for B | | Collinearity Statistics | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | | Lower Bound | Upper Bound | Tolerance | VIF |
| 1 | (Constant) | -65.350 | 18.154 | | -3.600 | .000 | -101.096 | -29.604 | | |
| | SBO | 1.026 | .036 | .872 | 28.861 | .000 | .956 | 1.097 | 1.000 | 1.000 |
| 2 | (Constant) | -50.186 | 14.211 | | -3.532 | .000 | -78.169 | -22.204 | | |
| | SBO | .612 | .042 | .520 | 14.477 | .000 | .528 | .695 | .431 | 2.319 |
| | PKO | .347 | .027 | .467 | 13.017 | .000 | .295 | .399 | .431 | 2.319 |
| 3 | (Constant) | -34.019 | 15.456 | | -2.201 | .029 | -64.453 | -3.585 | | |
| | SBO | .706 | .056 | .600 | 12.602 | .000 | .595 | .816 | .241 | 4.157 |
| | PKO | .334 | .027 | .450 | 12.444 | .000 | .281 | .387 | 416 | 2.403 |
| | CTO | -.089 | .035 | -.090 | -2.525 | .012 | -.158 | -.020 | .430 | 2.328 |

a. Dependent Variable: CPO

Table Q7(e)

**Excluded Variables [d]**

| Model | | Beta In | t | Sig. | Partial Correlation | Collinearity Statistics | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | Tolerance | VIF | Minimum Tolerance |
| 1 | PKO | .467[a] | 13.017 | .000 | .627 | .431 | 2.319 | .431 |
| | CTO | -.173[a] | -3.923 | .000 | -.236 | .445 | 2.246 | .445 |
| | SNO | .025[a] | .313 | .754 | .019 | .148 | 6.763 | .148 |
| | RSO | -.074[a] | -.710 | .479 | -.044 | .083 | 11.982 | .083 |
| 2 | CTO | -.090[b] | -2.525 | .012 | -.155 | .430 | 2.328 | .241 |
| | SNO | .065[b] | 1.064 | .288 | .066 | 147 | 6.780 | .119 |
| | RSO | .047[b] | .570 | .569 | .035 | .082 | 12.138 | .070 |
| 3 | SNO | .038[c] | .608 | .544 | .038 | .142 | 7.030 | .085 |
| | RSO | .041[c] | .509 | .611 | .032 | .082 | 12.147 | .061 |

a. Predictors in the Model: (Constant), SBO
b. Predictors in the Model: (Constant), SBO, PKO
c. Predictors in the Model: (Constant), SBO, PKO, CTO
d. Dependent Variable: CPO

**Appendix VI**

PEPERIKSAAN AKHIR

SEMESTER/SESI : SEMESTER II/09/10
MATA PELAJARAN : SIMULASI DAN PERAMALAN

KURSUS: 3 BPA
KOD MATA PELAJARAN: BPB3163

Figure Q7