KING FAHD UNIVERSITY OF PETROLEUM & MINERALS
DEPARTMENT OF MATHEMATICS AND STATISTICS
Term 152

STAT 212 BUSINESS STATISTICS II
Final Exam
Allowed time 135 minutes
Wednesday May 11, 2016

Name:_____ ID #:_____ Section #:_____ Srl #:____

Important Note:

1) You must **show all work** to obtain full credit for questions on this exam.
2) **DO NOT round** your answers at each step. Round answers only if necessary at your final step to **4 decimal places**.

Question No	Full Marks	Marks Obtained
Q1	16	
Q2	27	
Q3	21	
Q4	18	
Q5	8	
Total	**90**	

Question One (17 *points*):

The following table represents the annual incident rates (cases/100,000 persons) of reported some acute disease recorded over five-year period from 1975 to 2015:

Year (*t*)	1975	1980	1985	1990	1995	2000	2005	2010	2015
Rate (*Y*)	3.1	2.2	5.3	7.5	8.5	7.4	10.3	22.1	17.6

a. Compute the linear trend forecasting model. (3 *points*)

b. Interpret the linear trend model regression coefficients. (4 *points*)

c. Compute the forecast error of the incidence rate for 2015. (3 *points*)

d. Based on the Minitab output below which of the three autoregressive models is significant in forecasting the incidence rate? Explain (4 *points*)

e. Use the third order autoregressive model to forecast the incidence rate for 2015. (2 *points*)

The following MINITAB output shows the results of fitting first order, second order, and third order autoregressive models:

Regression Analysis: Y versus Y-1

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The regression equation is
Y = 3.75 + 0.766 Y-1

8 cases used, 1 cases contain missing values

Predictor    Coef  SE Coef     T      P    VIF
Constant    3.754    3.027  1.24  0.261
Y-1        0.7661   0.2990  2.56  0.043  1.000


S = 4.90515   R-Sq = 52.3%   R-Sq(adj) = 44.3%
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Regression Analysis: Y versus Y-1, Y-2

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The regression equation is
Y = 3.80 + 0.494 Y-1 + 0.47 Y-2

7 cases used, 2 cases contain missing values

Predictor    Coef  SE Coef     T      P    VIF
Constant    3.797    5.361  0.71  0.518
Y-1        0.4941   0.5859  0.84  0.447  2.721
Y-2         0.470    1.260  0.37  0.728  2.721

S = 5.48277   R-Sq = 47.9%   R-Sq(adj) = 21.9%
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Regression Analysis: Y versus Y-1, Y-2, Y-3

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The regression equation is
Y = 2.76 + 0.619 Y-1 - 1.46 Y-2 + 2.33 Y-3

6 cases used, 3 cases contain missing values

Predictor    Coef  SE Coef      T      P    VIF
Constant    2.764    5.685   0.49  0.675
Y-1        0.6185   0.5248   1.18  0.360  2.219
Y-2        -1.464    1.533  -0.96  0.440  4.059
Y-3         2.334    1.305   1.79  0.216  2.474

S = 4.77410   R-Sq = 76.0%   R-Sq(adj) = 39.9%
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Question Two (27 *points*):

The table below contains the prices of basket of food items from the first quarter of 2007 to the third quarter of 2010. Included are the prices (in dollars) for a pound loaf of bread, a pound of beef, a dozen large eggs, and a pound of lettuce. Recall that;

MA(L) = Moving Average with period length L.

E(W) = Exponentially smoothed time series with constant W.

Year-Quarter	Bread	Beef	Eggs	Lettuce	Bread-MA(3)	Beef-MA(7)	Eggs-E(0.25)	Lettuce-E(0.8)
2007-1	0.726	1.926	0.933	0.573				
2007-2	0.748	1.97	0.898	0.625	0.7473		0.9243	0.6146
2007-3	0.768	1.892	0.917	0.506			0.9224	0.5277
2007-4	0.767	1.847	0.882	0.821	0.7983	1.8717	0.9123	0.7623
2008-1	0.86	1.799	1.155	0.769	0.8297	1.8586	0.9730	0.7677
2008-2	0.862	1.85	1.148	0.651	0.8590	1.8490		0.6743
2008-3	0.855	1.818	1.12	1.072	0.8630		1.0426	0.9925
2008-4	0.872	1.834	1.053	0.649	0.8780	1.9131	1.0452	0.7177
2009-1	0.907	1.903	0.975	0.748	0.9203	1.9606	1.0276	0.7419
2009-2	0.982	2.037	1.011	0.736	0.9633	2.0656	1.0235	0.7372
2009-3	1.001	2.151	0.973	1.003		2.1599	1.0109	0.9498
2009-4	1.042	2.131	1.175	0.734	0.9963	2.2703	1.0519	0.7772
2010-1	0.946	2.585	1.573	0.876	0.9950		1.1822	0.8562
2010-2	0.997	2.478	1.211	0.817	0.9963		1.1894	
2010-3	1.046	2.607	1.449	0.874			1.2543	0.8642

Given that a family consumed 50 loaves of bread, 22 pounds of beef, 24 dozen eggs, and 18 pounds of lettuce in the second quarter of 2007 and that family also consumed 55 loaves of bread, 17 pounds of beef, 20 dozen eggs, and 28 pounds of lettuce in the third quarter of 2009, use the table above to answer the following:

a. Fill in the blanks in the above table. (6 *points*)

b. Compute the price index number of Bread in the third quarter of 2009 based on the second quarter of 2007. (2 *points*)

c. Compute the unweighted aggregate price index number for the second quarter of 2007 based on the third quarter of 2009. (2 *points*)

d. Compute Paasche price index number for third quarter of 2009 based on the second quarter of 2007. (4 *points*)

Using the Minitab output below, answer the following:

e. Interpret the intercept and the regression coefficients of t and Q_1 in the context of this problem. (5 *points*)

f. Forecast the egg price in the first quarter of 2011. (2 *points*)

g. Do you think there is seasonality in this time series? Explain. (6 *points*)

The Minitab output below shows the results of fitting an exponential model with quarterly data:

Regression Analysis: ln(Eggs) versus t, Q1, Q2, Q3

The regression equation is
ln(Eggs) = - 0.175 + 0.0292 t + 0.126 Q1 + 0.0291 Q2 + 0.0342 Q3

Predictor	Coef	SE Coef	T	P	VIF
Constant	-0.17538	0.08958	-1.96	0.079	
t	0.029214	0.007580	3.85	0.003	1.029
Q1	0.12570	0.09578	1.31	0.219	1.722
Q2	0.02909	0.09548	0.30	0.767	1.711
Q3	0.03422	0.09578	0.36	0.728	1.722

S = 0.125017 R-Sq = 61.6% R-Sq(adj) = 46.2%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	4	0.25076	0.06269	4.01	0.034
Residual Error	10	0.15629	0.01563		
Total	14	0.40705			

Durbin-Watson statistic = 1.34714

Predicted Values for New Observations

New Obs	Fit	SE Fit	95% CI	95% PI
1	0.4177	0.0983	(0.1988, 0.6367)	(0.0635, 0.7720)

Values of Predictors for New Observations

New Obs	t	Q1	Q2	Q3
1	16.0	1.00	0.000000	0.000000

Question Three (21 *points*):

Researchers studied the goals and outcomes of 349 work teams from various manufacturing companies. Teams are categorized as to whether they had specified environmental improvements as a goal and also according to the manufacturing process. The results are shown in the Excel output below

Chi-Square Test

Observed Frequencies

	Type of Manufacturing Process			
Environmental Goal	Job shop or batch	Repetitive batch	Discrete process	Continuous process
Yes	2	4	15	17
No	42	57	147	65

Level of Significance	0.05
Square Root of Critical Value	

Expected Frequencies

	Type of Manufacturing Process			
Environmental Goal	Job shop or batch	Repetitive batch	Discrete process	Continuous process
Yes	4.7908		17.639	
No		54.3582	144.361	73.0716

(fo-fe)^2/fe			
	1.0508	0.3948	7.2971
0.1986	0.1284		0.8916

Proportions	Absolute Differences	Critical Range
| Group 1 - Group 2 |	0.02012	0.124723
| Group 1 - Group 3 |	0.04713	
| Group 1 - Group 4 |		0.152864
| Group 2 - Group 3 |	0.02701	0.1091
| Group 2 - Group 4 |	0.14165	0.153334
| Group 3 - Group 4 |	0.11472	0.14041

Sample Proportions	
Group 1	0.0455
Group 2	
Group 3	0.0926
Group 4	0.2073

a. Complete the table above. (12 *points*)

b. Is there evidence that the four types of manufacturing process are different in terms of their environmental goal? (6 *points*)

c. If your answer on part b is yes, which types are different? Explain. (3 *points*)

Question Four (18 *points*):

A study, contains information regarding eight variables, was made using a sample of 868 mutual funds to predict the 2006 return (Y). The variables list follows:

Category–Type of stocks comprising the mutual fund (small cap(X2), mid cap, or large cap(X1))
Objective–Objectives of stocks comprising the fund (growth(X3) or value)
Fees–Sales charges (yes(X4) or no)
Expense ratio(X5)–Ratio of expenses to net assets, in percentage
Risk–Risk-of-loss factor of the mutual fund (low, average(X6), or high (X7))
Assets(X8)–In millions of dollars

The results of a multiple regression analysis are in the Excel output below

Regression Analysis

Regression Statistics	
Multiple R	0.6851
R Square	
Adjusted R Square	0.4645
Standard Error	4.6041
Observations	868

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression				94.9986	8.409E-113
Residual			21.1980		
Total	867	34319.3357			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept		0.6894	28.0502	0.0000	17.9851	20.6914
L Cap	-0.7738		-1.8481	0.0649	-1.5957	0.0480
S Cap	2.2147	0.4696		0.0000	1.2930	3.1363
Growth Obj	-6.4912	0.3996	-16.2428	0.0000	-7.2756	-5.7068
Fees	0.1621	0.3287	0.4932	0.6220		0.8071
Expense Ratio	-1.2935	0.4512	-2.8668	0.0042	-2.1791	-0.4079
A Risk	-1.9519	0.4507	-4.3306	0.0000	-2.8365	-1.0672
H Risk	-3.4146	0.5434	-6.2832	0.0000	-4.4813	-2.3480
Assets	0.0000	0.0000	-0.2308	0.8175	-0.0001	0.0001

Correlation Matrix

	L Cap	S Cap	Growth Obj	Fees	Expense Ratio	A Risk	H Risk	Assets	Return 2006
L Cap	1								
S Cap	-0.6488	1							
Growth Obj	-0.0442	-0.0433	1						
Fees	0.03834	-0.0594	0.00599	1					
Expense Ratio	-0.1723	0.17936	0.10071	0.24776	1				
A Risk	0.06139	-0.029	-0.1264	-0.0041	-0.0608	1			
H Risk	-0.2675	0.22001	0.52724	0.01656	0.2081	-0.6216	1		
Assets	0.11432	-0.089	-0.0986	-0.0399	-0.2857	-0.0234	-0.1229	1	
Return 2006	-0.0658	0.15172	-0.6483	-0.0253	-0.1336	0.07875	-0.4102	0.08197	1

Stepwise Analysis
Table of Results for General Stepwise

Growth Obj entered.

	df	SS	MS	F	Signif F
Regression	1	14424.393	14424.39	627.8744	0.0000
Residual	866	19894.942	22.9734		
Total	867	34319.336			

	Coefficients	Standard Error	t Stat	P-value
Intercept	16.8829	0.2385	70.7988	0.0000
Growth Obj	-8.1726	0.3262	-25.0574	0.0000

S Cap entered.

	df	SS	MS	F	Signif F
Regression	2	14949.8876	7474.9438	333.8157	0.0000
Residual	865	19369.4481	22.3924		
Total	867	34319.3357			

	Coefficients	Standard Error	t Stat	P-value
Intercept	16.3598	0.2590	63.1608	0.0000
Growth Obj	-8.1049	0.3223	-25.1467	0.0000
S Cap	1.7325	0.3576	4.8443	0.0000

H Risk entered.

	df	SS	MS	F	Signif F
Regression	3	15451.4872	5150.4957	235.8525	0.0000
Residual	864	18867.8485	21.8378		
Total	867	34319.3357			

	Coefficients	Standard Error	t Stat	P-value
Intercept	16.4563	0.2566	64.1367	0.0000
Growth Obj	-7.0983	0.3813	-18.6140	0.0000
S Cap	2.2378	0.3686	6.0715	0.0000
H Risk	-1.8990	0.3962	-4.7926	0.0000

A Risk entered.

	df	SS	MS	F	Signif F
Regression	4	15865.2493	3966.3123	185.4834	0.0000
Residual	863	18454.0864	21.3836		
Total	867	34319.3357			

	Coefficients	Standard Error	t Stat	P-value

Intercept	17.3943	0.3316	52.4606	0.0000
Growth Obj	-6.4998	0.4011	-16.2036	0.0000
S Cap	2.5874	0.3733	6.9315	0.0000
H Risk	-3.4860	0.5328	-6.5425	0.0000
A Risk	-1.9737	0.4487	-4.3988	0.0000

Expense Ratio entered.

	df	*SS*	*MS*	*F*	*Signif F*
Regression	5	16031.4910	3206.2982	151.1293	0.0000
Residual	862	18287.8447	21.2156		
Total	867	34319.3357			

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	18.6406	0.5544	33.6258	0.0000
Growth Obj	-6.5089	0.3996	-16.2898	0.0000
S Cap	2.7166	0.3747	7.2508	0.0000
H Risk	-3.2625	0.5367	-6.0787	0.0000
A Risk	-1.8863	0.4480	-4.2105	0.0000
Expense Ratio	-1.1788	0.4211	-2.7993	0.0052

No other variables could be entered into the model. Stepwise ends.

a. Complete the table of the regression analysis above. (10 *points*)
b. Give two reasons for not including the variable Fees in the stepwise model? (2 *points*)

c. Using the stepwise model, estimate the 2006 Return for a mutual fund which belongs to the large cap category, with a value objective, with low risk, of no fees, with expense ratio of 1.33%, and has assets of 1169 $million. (2 *points*)

d. Compute the percentage of the variation in the 2006 Return that was explained by the variation in the independent variables in the stepwise model. (2 *points*)

e. Compute the standard error of the estimate of the stepwise model. (2 *points*)

Question Five (8 *points*):

Can students save money by comparison shopping for textbooks at Amazon.com? To investigate this issue, a random sample, of 10 textbooks, was selected. The prices (in $US) for these text books at both a local book store and through Amazon.com are given below

Book Name	Book Store	Amazon
Principles of Microeconomics	120.00	101.22
Calculus: Early Transcendentals	137.50	115.33
Manual de Gramatica	82.75	71.36
Modern Architecture Since 1900	39.95	26.37
Commercial Banking	120.00	108.99
Chemistry in Context	133.75	102.30
Universal Principles of Design	40.00	26.40
In Mixed Company	79.50	68.76
International Marketing	154.75	126.15
Enterprise Information Systems	155.75	126.97

At the 1% significance level, do the data support that Amazon.com prices are lower than the local bookstore's for the *same* textbook?