

Econometrics--Econ 388

Fall 2001, Richard Butler

Final Exam

your name \_\_\_\_\_

Section Problem Points Possible

I 1-20 3 points each

II 21 20 points

22 5 points

23 5 points

24 5 points

25 5 points

III 27 20 points

28 20 points

IV 29 30 points

30 30 points

I. Define or explain the following terms:

1. seasonal dummy variables-

2. chow test -

3. coefficient of determination -

4. consistency (of an estimator)-

5. degrees of freedom (in a regression model) -

6. elasticity-

7. exogeneous variables -

8. F-distribution-

9. Type II error-

10. Hausman test-

11. idempotent matrix-

12. instrumental variables-

13. Lagrange multiplier test-

14. linear probability model-

15. strict stationary process-

16. omitted variable bias-

17. prediction interval (forecasting a point)-

18. random walk-

19. plim--

20. unbiased estimators-

II. Some Concepts

21. Suppose that two random variables are constructed from rolling a fair dice twice. Define  $Z$  to be a random variable whose value equals the absolute value of the difference in the two rolls (so  $Z = 0, 1, 2, 3, 4$  or  $5$ ). Define  $W$  to be the random variable whose value equals one if the sum of the two rolls is 6 or less ( $W=1$  if the experimental outcome is '1,1' '1,2' '1,3' '1,4' '1,5' ...etc.) and  $W=0$  otherwise (the sum of upturned dots on the two rolls is 7 or greater (for example, rolling a '1,6' or '3,4' or '4, 5' for example).

A. Fill in the joint probability density function for the following table (i.e., indicate what the joint probabilities of each of the outcomes are):

	$Z=0$	$Z=1$	$Z=2$	$Z=3$	$Z=4$	$Z=5$
$W=1$						
$W=0$						

B. calculate the marginal probability densities  $f(Z)$  and  $f(W)$

C. Calculate  $E(W)$  and  $V(W)$  (no credit unless you show the right formulas).

D. Calculate the conditional probability density  $f(W|Z=5)$  (again, no credit unless you show the right formulas)

E. Are  $W$  and  $Z$  independent? Why or why not?

The next four questions consist of statements that are True, False, or Uncertain (Sometimes True). You are graded solely on the basis of your explanation in your answer

22. "Though there is a consensus (unique) decomposition of the variation in Y that is explained by the variation in the independent variables X for a linear model, there is no such consensus (unique) decomposition for non-linear models."

23. "In a simultaneous equation system, the more the number of exogenous variables the better."

24. "A second order moving average process is stationary but not weakly dependent."

25. "Least squares estimators are random variables, but least squares estimates are not."

### III. Some Applications

26.

Shazam code: (gpa=pre-class gpa, tuce\_scr=test of prior information,  
psi=program intervention, prep course, a\_grade=1 if A for course, 0 else)  
sample 1 32

```
read(aldr_lpm.txt) gpa tuce_scr psi a_grade
stat
ols a_grade gpa tuce_scr psi / predict=yhat
if (YHAT.GE.1) YHAT=.999
if (YHAT.LE.0) YHAT=.001
GENR WT = 1 / (YHAT*(1-YHAT))
list a_grade yhat gpa tuce_scr psi
OLS a_grade gpa tuce_scr psi / WEIGHT = WT
logit a_grade gpa tuce_scr psi
```

\*\*\*\*\*

NAME	N	MEAN	ST. DEV	VARIANCE	MINIMUM	MAXIMUM
GPA	32	3.1172	0.46671	0.21782	2.0600	4.0000
TUCE_SCR	32	21.938	3.9015	15.222	12.000	29.000
PSI	32	0.43750	0.50402	0.25403	0.0000	1.0000
A_GRADE	32	0.34375	0.48256	0.23286	0.0000	1.0000

```
|_ols a_grade gpa tuce_scr psi / predict=yhat
```

R-SQUARE = 0.4159      R-SQUARE ADJUSTED = 0.3533

VARIABLE	ESTIMATED	STANDARD	T-RATIO	PARTIAL	STANDARDIZED	ELASTICITY
NAME	COEFFICIENT	ERROR	28 DF	P-VALUE	CORR. COEFFICIENT	AT MEANS
GPA	0.46385	0.1620	2.864	0.008	0.476	4.2063
TUCE_SCR	0.10495E-01	0.1948E-01	0.5387	0.594	0.101	0.6698
PSI	0.37855	0.1392	2.720	0.011	0.457	0.4818
CONSTANT	-1.4980	0.5239	-2.859	0.008	-0.475	-4.3579

```
|_if (YHAT.GE.1) YHAT=.999
|_if (YHAT.LE.0) YHAT=.001
|_GENR WT = 1 / (YHAT*(1-YHAT))
```

```
|_OLS a_grade gpa tuce_scr psi / WEIGHT = WT
```

VARIABLE	ESTIMATED	STANDARD	T-RATIO	PARTIAL	STANDARDIZED	ELASTICITY
NAME	COEFFICIENT	ERROR	28 DF	P-VALUE	CORR. COEFFICIENT	AT MEANS
GPA	0.39817	0.8783E-01	4.533	0.000	0.651	61.5418
TUCE_SCR	0.12156E-01	0.4542E-02	2.676	0.012	0.451	12.1109
PSI	0.38782	0.1052	3.687	0.001	0.572	0.4881
CONSTANT	-1.3087	0.2885	-4.536	0.000	-0.651	-73.1408

```
|_logit a_grade gpa tuce_scr psi
```

VARIABLE	ESTIMATED	STANDARD	ASYMPTOTIC	ELASTICITY	WEIGHTED
NAME	COEFFICIENT	ERROR	T-RATIO	AT MEANS	AGGREGATE
GPA	2.8261	1.2629	2.2378	6.5823	3.4252
TUCE_SCR	0.95158E-01	0.14155	0.67226	1.5598	0.81153
PSI	2.3787	1.0645	2.2345	0.77757	0.49338
CONSTANT	-13.021	4.9310	-2.6407	-9.7293	-4.8599

LOG-LIKELIHOOD FUNCTION = -12.890  
LOG-LIKELIHOOD(0) = -20.592  
LIKELIHOOD RATIO TEST = 15.4042 WITH 3 D.F.

Explain what the circled output indicates on the preceding page:

A.

B.

C.

D.

E.

F.

G.

H.

I.

J.

27. Shazam code (sales=restaurant sales in thous \$, ave\_inc=average income of persons within 3 mile radius, populat=number of people living within a 3 mile radius, competn=number of competitors within a 3 mile radius)

```

ols sales ave_inc populat competn / resid=resids
genr residsq=resids*resids
genr lnres_sq=log(residsq)
ols lnres_sq ave_inc populat competn / predict=res_hat
genr inv_wt = exp(res_hat)
genr wt = 1 / inv_wt
ols sales ave_inc populat competn / weight=wt
ols sales ave_inc populat competn / hetcov
stop

```

R-SQUARE = 0.6182 R-SQUARE ADJUSTED = 0.5787

VARIABLE NAME	ESTIMATED COEFFICIENT	STANDARD ERROR	T-RATIO	29 DF	P-VALUE	PARTIAL CORR.	STANDARDIZED COEFFICIENT	ELASTICITY AT MEANS
AVE_INC	1.2879	0.5433	2.371		0.025	0.403	0.2956	0.2107
POPULAT	0.35467	0.7268E-01	4.880		0.000	0.671	0.8847	0.2933
COMPETN	-9074.7	2053.	-4.421		0.000	-0.635	-0.7774	-0.3174
CONSTANT	0.10219E+06	0.1280E+05	7.984		0.000	0.829	0.0000	0.8134

```

|_genr residsq=resids*resids
|_genr lnres_sq=log(residsq)
|_ols lnres_sq ave_inc populat competn / predict=res_hat

```

R-SQUARE = 0.0470 R-SQUARE ADJUSTED = -0.0516

VARIABLE NAME	ESTIMATED COEFFICIENT	STANDARD ERROR	T-RATIO	29 DF	P-VALUE	PARTIAL CORR.	STANDARDIZED COEFFICIENT	ELASTICITY AT MEANS
AVE_INC	0.18774E-05	0.7293E-04	0.2574E-01		0.980	0.005	0.0051	0.0022
POPULAT	0.32175E-05	0.9756E-05	0.3298		0.744	0.061	0.0945	0.0188
COMPETN	-0.27241	0.2755	-0.9887		0.331	-0.181	-0.2747	-0.0673
CONSTANT	18.610	1.718	10.83		0.000	0.895	0.0000	1.0463

```

|_genr inv_wt = exp(res_hat)
|_genr wt = 1 / inv_wt
|_ols sales ave_inc populat competn / weight=wt

```

R-SQUARE = 0.6253 R-SQUARE ADJUSTED = 0.5865

VARIABLE NAME	ESTIMATED COEFFICIENT	STANDARD ERROR	T-RATIO	29 DF	P-VALUE	PARTIAL CORR.	STANDARDIZED COEFFICIENT	ELASTICITY AT MEANS
AVE_INC	1.2555	0.5379	2.334		0.027	0.398	0.2742	0.2079
POPULAT	0.34326	0.6135E-01	5.595		0.000	0.721	0.9150	0.3237
COMPETN	-8130.8	1650.	-4.926		0.000	-0.675	-0.7976	-0.3470
CONSTANT	99594.	0.1273E+05	7.824		0.000	0.824	0.0000	0.8154

```

|_ols sales ave_inc populat competn / hetcov

```

VARIABLE NAME	ESTIMATED COEFFICIENT	STANDARD ERROR	T-RATIO	29 DF	P-VALUE	PARTIAL CORR.	STANDARDIZED COEFFICIENT	ELASTICITY AT MEANS
AVE_INC	1.2879	0.4523	2.848		0.008	0.467	0.2956	0.2107
POPULAT	0.35467	0.6054E-01	5.858		0.000	0.736	0.8847	0.2933
COMPETN	-9074.7	1751.	-5.182		0.000	-0.693	-0.7774	-0.3174
CONSTANT	0.10219E+06	0.1126E+05	9.076		0.000	0.860	0.0000	0.8134

Explain what the circled output indicates on the preceding page:

A.

B.

C.

D.

E.

F.

G.

H.

I.

J.

### III. Some Proofs

28. Prove that under the standard assumptions, the OLS estimators are BLUE: Best Linear Unbiased Estimators (that they have the smallest variance among all the linear, unbiased estimators of the model  $Y = X\beta + \mu$ ).

29. Prove that under the standard assumptions (plus whatever large sample assumptions you need to make—be explicit what they are), the OLS estimators are consistent for the model  $Y = X\beta + \mu$ .