University of Oregon
Department of Economics

EC320 – Practice Final

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Name: ______________________________

UO ID: ______________________________

This exam contains 11 pages (including this cover page) and 19 questions. Total of points is 120.

Question	Points	Score
1	5	
2	5	
3	5	
4	5	
5	5	
6	5	
7	5	
8	5	
9	5	
10	5	
11	5	
12	5	
13	5	
14	5	
15	10	
16	10	
17	10	
18	10	
19	10	
Total:	120	

Multiple Choice

Each question has a single answer and is worth 5 points. Clearly mark your response. No explanation required.

1. (5 points) The intercept in $y_i = \beta_0 + \beta_1 x_i + u_i$ tells us.
   (a) The expected value of y_i when $x_i = \bar{x}$
   (b) The expected value of y_i when $x_i = 0$.
   (c) The effect of x on y
   (d) None of the above

2. (5 points) Which assumption is **NOT** requied for OLS to be the best linear unbiased estimator (BLUE).
   (a) Linearity
   (b) No perfect colinearity
   (c) Exogeneity
   (d) Homoskedasticity.
   (e) Non autocorrelation
   (f) Normality of error term
   (g) All of the above are required for OLS to be BLUE.

3. (5 points) By specifying that a hypothesis test should be run at the α percent level, we are saying that
   (a) We are OK with rejecting the null hypothesis when α percent of the time, the null is actually true
   (b) We are OK with failing to reject the null hypothesis when α percent of the time, the null is actually false
   (c) Our estimate is within α percent of the true population parameter.
   (d) both A and B
   (e) None of the above

4. (5 points) If we have a log-linear model, the we interpret the coefficient on x as
   (a) A one unit increase in x leads to a $100 \times \beta$ percent increase in y
   (b) A one percent increase in x leads to a $100 \times \beta$ unit increase in y
   (c) A one percent increase in x leads to a β percent increase in y
   (d) A one unit increase in x leads to a β unit increase in y
   (e) none of the above

5. (5 points) Suppose we run the regression $y_i = \beta_0 + \beta_1 D_i + u_i$, where D_i is an indicator variable for whether individual i received treatment. What is the interpretation of β_1?
   (a) The expected value of y for the treated group.
   (b) The expected value of y for the untreated group
   (c) The difference in the expected value of y for the treated group relative to the control group.
   (d) The effect of a one unit increase in treatment intensity on y
   (e) None of the above

6. (5 points) Suppose we have the model $y_i = \beta_0 + \beta_1 x_i + \beta_2 D_i + \beta_3 x_i \times D_i + u_i$. What is the interpretation of the β_3?
   (a) The effect of x_i on y when $D_i = 1$
   (b) The effect of x_i on y
   (c) The effect of x_i on y when $D_i = 0$
   (d) The effect of x_i on y for treated relative to the untreated group
   (e) None of the above

True or False

Circle either True or False, no explanation required. Each question is worth 5 points.

7. (5 points) True or False? The point $(\bar{x}, \bar{y})$ is only on the regression line sometimes.

8. (5 points) True or False? Our non-autocorrelation assumption says there can be no correlation between x's for different observations, that is $E[x_i x_j] = 0$ for all $i \neq j$

9. (5 points) True or False? A 95 percent confidence interval will be smaller than a 99 percent confidence interval.

10. (5 points) True or False? We cannot estimate $y_i = \beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + \beta_3 x_{1i} \times x_{2i} + u_i$ with OLS because it violates our linearity assumption.

11. (5 points) True or False? Adding more variables to a regression mechanically increases R-squared.

12. (5 points) True or False? $y_i = \beta_0 + \beta_1^{\beta_2} x_i + u_i$ is linear in variables

13. (5 points) True or False? Adding dummy variables allows for different intercepts for two groups.

14. (5 points) True or False? If we have an ideal proxy for x_2, then the coefficient on x_1 is unaffected

Short Answer

Provide a written response to each question, where it is clearly marked which question you are responding to. Use the back of the page if you need additional space. Show all of your work.

15. **Simple Linear Regression Estimation** Suppose we want to estimate the model $y_i = \beta_0 + \beta_1 x_i + u_i$.
    (a) (3 points) Write down the formula for the OLS estimator $\hat{\beta}_1$.
    (b) (2 points) How did we derive the formula for the OLS estimator?
    (c) (2 points) Write down the definition of fitted values and residuals.
    (d) (3 points) Explain intuitively what R-squared measures and the formula for how we calculate it.

16. **Marginal Effects**. Suppose we have the model $y_i = \beta_0 + \beta_1 x_i + \beta_2 x^2 + u_i$.

    (a) (3 points) Derive an expression for the marginal effect of x on y.

    (b) (4 points) Suppose we get OLS estimates $\hat{\beta}_1 = 4$ and $\hat{\beta}_2 = 8$. Calculate our estimate of the marginal effect when $x = 1$ and $x = 10$, interpret those results.

    (c) (3 points) Find the value for x where we estimate y to be its highest.

17. **Log Transformations**

(a) (1 point) What is the interpretation of β_1 in $y_i = \beta_0 + \beta_1 x + u_i$?

(b) (3 points) What is the interpretation of β_1 in $y_i = \beta_0 + \beta_1 \log x + u_i$?

(c) (3 points) What is the interpretation of β_1 in $\log y_i = \beta_0 + \beta_1 x + u_i$?

(d) (3 points) What is the interpretation of β_1 in $\log y_i = \beta_0 + \beta_1 \log x + u_i$?

18. **Dummy Variables**. Suppose we are interested to test whether white households are exposed to less air pollution than non-white households and run the model $AQI_i = \beta_0 + \beta_1 White_i + u_i$. Where AQI_i is a measure of the average air quality index where individual i lives and $White_i$ is a binary variable equal to 1 if individual i is white.

Dependent Variable:	AQI_i
Variables	
$White_i$	-3.31
	(1.84)
(Intercept)	20.12
	(2.36)
Fit statistics	
Observations	10,591
R^2	0.011

Standard errors are reported in parenthesis.

(a) (2 points) Interpret $\hat{\beta}_0$.

(b) (2 points) Interpret $\hat{\beta}_1$.

(c) (2 points) What is average AQI for white individuals?

(d) (4 points) Is there evidence of a different air quality levels for white vs non-white individuals? Specify the test you are going to run, the null and alternative hypotheses, and the conclusion for your test.

19. **Interaction Terms**. Suppose we are interested in the effect that the length of a prison sentence has wages, and in particular whether that effect differs by race. Suppose we estimate the model $y_i = \beta_0 + \beta_1 Yrs_i + \beta_2 White_i + \beta_3 Yrs_i \times White_i + u_i$, where y_i is hourly wage in dollars, Yrs_i is the number of years individual i has served in prison, and $White_i$ is a binary variable indicating whether individual i is white.

Dependent Variable:	Hourly Wage
Variables	
Yrs_i	-1.43
	(0.44)
$White_i$	4.14
	(0.95)
$Yrs_i \times White_i$	0.30
	(0.13)
(Intercept)	20.12
	(2.36)
Fit statistics	
Observations	987
R^2	0.058

Standard errors are reported in parenthesis.

(a) (3 points) Interpret the coefficient on interaction term.

(b) (2 points) Derive an expression for the marginal effect of Yrs on earnings y.

(c) (2 points) Calculate the marginal effect of Yrs on y for both treated and untreated groups

(d) (3 points) Is there statistical evidence that the effect of Yrs on y is different for white and non-white individuals? Specify the null and alternative hypotheses, the test statistic, the conclusion of the test, and the interpretation of that conclusion.

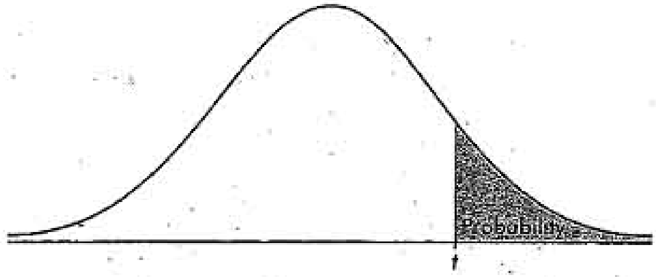

TABLE B: t-DISTRIBUTION CRITICAL VALUES

	Tail probability p											
df	.25	.20	.15	.10	.05	.025	.02	.01	.005	.0025	.001	.0005
1	1.000	1.376	1.963	3.078	6.314	12.71	15.89	31.82	63.66	127.3	318.3	636.6
2	.816	1.061	1.386	1.886	2.920	4.303	4.849	6.965	9.925	14.09	22.33	31.60
3	.765	.978	1.250	1.638	2.353	3.182	3.482	4.541	5.841	7.453	10.21	12.92
4	.741	.941	1.190	1.533	2.132	2.776	2.999	3.747	4.604	5.598	7.173	8.610
5	.727	.920	1.156	1.476	2.015	2.571	2.757	3.365	4.032	4.773	5.893	6.869
6	.718	.906	1.134	1.440	1.943	2.447	2.612	3.143	3.707	4.317	5.208	5.959
7	.711	.896	1.119	1.415	1.895	2.365	2.517	2.998	3.499	4.029	4.785	5.408
8	.706	.889	1.108	1.397	1.860	2.306	2.449	2.896	3.355	3.833	4.501	5.041
9	.703	.883	1.100	1.383	1.833	2.262	2.398	2.821	3.250	3.690	4.297	4.781
10	.700	.879	1.093	1.372	1.812	2.228	2.359	2.764	3.169	3.581	4.144	4.587
11	.697	.876	1.088	1.363	1.796	2.201	2.328	2.718	3.106	3.497	4.025	4.437
12	.695	.873	1.083	1.356	1.782	2.179	2.303	2.681	3.055	3.428	3.930	4.318
13	.694	.870	1.079	1.350	1.771	2.160	2.282	2.650	3.012	3.372	3.852	4.221
14	.692	.868	1.076	1.345	1.761	2.145	2.264	2.624	2.977	3.326	3.787	4.140
15	.691	.866	1.074	1.341	1.753	2.131	2.249	2.602	2.947	3.286	3.733	4.073
16	.690	.865	1.071	1.337	1.746	2.120	2.235	2.583	2.921	3.252	3.686	4.015
17	.689	.863	1.069	1.333	1.740	2.110	2.224	2.567	2.898	3.222	3.646	3.965
18	.688	.862	1.067	1.330	1.734	2.101	2.214	2.552	2.878	3.197	3.611	3.922
19	.688	.861	1.066	1.328	1.729	2.093	2.205	2.539	2.861	3.174	3.579	3.883
20	.687	.860	1.064	1.325	1.725	2.086	2.197	2.528	2.845	3.153	3.552	3.850
21	.686	.859	1.063	1.323	1.721	2.080	2.189	2.518	2.831	3.135	3.527	3.819
22	.686	.858	1.061	1.321	1.717	2.074	2.183	2.508	2.819	3.119	3.505	3.792
23	.685	.858	1.060	1.319	1.714	2.069	2.177	2.500	2.807	3.104	3.485	3.768
24	.685	.857	1.059	1.318	1.711	2.064	2.172	2.492	2.797	3.091	3.467	3.745
25	.684	.856	1.058	1.316	1.708	2.060	2.167	2.485	2.787	3.078	3.450	3.725
26	.684	.856	1.058	1.315	1.706	2.056	2.162	2.479	2.779	3.067	3.435	3.707
27	.684	.855	1.057	1.314	1.703	2.052	2.158	2.473	2.771	3.057	3.421	3.690
28	.683	.855	1.056	1.313	1.701	2.048	2.154	2.467	2.763	3.047	3.408	3.674
29	.683	.854	1.055	1.311	1.699	2.045	2.150	2.462	2.756	3.038	3.396	3.659
30	.683	.854	1.055	1.310	1.697	2.042	2.147	2.457	2.750	3.030	3.385	3.646
40	.681	.851	1.050	1.303	1.684	2.021	2.123	2.423	2.704	2.971	3.307	3.551
50	.679	.849	1.047	1.299	1.676	2.009	2.109	2.403	2.678	2.937	3.261	3.496
60	.679	.848	1.045	1.296	1.671	2.000	2.099	2.390	2.660	2.915	3.232	3.460
80	.678	.846	1.043	1.292	1.664	1.990	2.088	2.374	2.639	2.887	3.195	3.416
100	.677	.845	1.042	1.290	1.660	1.984	2.081	2.364	2.626	2.871	3.174	3.390
1000	.675	.842	1.037	1.282	1.646	1.962	2.056	2.330	2.581	2.813	3.098	3.300
∞	.674	.841	1.036	1.282	1.645	1.960	2.054	2.326	2.576	2.807	3.091	3.291
	50%	60%	70%	80%	90%	95%	96%	98%	99%	99.5%	99.8%	99.9%
	Confidence level C											