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UNIVERSITY OF ESWATINI

RE-SIT / SUPPLEMENTARY EXAMINATION PAPER

PROGRAMME: B.Sc. in Agricultural Economics and Agribusiness Management
Year 3

COURSE CODE: AEM 307

TITLE OF PAPER: INTRODUCTION TO ECONOMETRICS

TIME ALLOWED: TWO (2) HOURS

INSTRUCTION: 1.
2.

ANSWER ALL QUESTIONS
EACH QUESTION CARRIES TWENTY FIVE (25)
MARKS

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THE CHIEF INVIGILATOR

QUESTION 1

A researcher has data on the following variables for 5,061 respondents in the National Longitudinal Survey of Youth 1979-:

- MARRIED, marital status in 1994, defined to be 1 if the respondent was married with spouse present and 0 otherwise;
- MALE, defined to be 1 if the respondent was male and 0 if female;
- AGE in 1994 (the range being 29-37);
- S, years of schooling, defined as highest grade completed, and
- ASVABC, score on a test of cognitive ability, scaled so as to have mean 50 and standard deviation 10.

The researcher uses probit analysis to regress MARRIED on the other variables, with the output shown:

Probit estimates

Log likelihood = -3286.1289

Number of obs = 5061
LR chi2(4) = 229.78
Prob > chi2 = 0.0000
Pseudo R2 = 0.0338

MARRIED	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
MALE	-.1215281	.036332	-3.34	0.001	-.1927375	-.0503188
AGE	.028571	.0081632	3.50	0.000	.0125715	.0445705
S	-.0017465	.00919	-0.19	0.849	-.0197587	.0162656
ASVABC	.0252911	.0022895	11.05	0.000	.0208038	.0297784
_cons	-1.816455	.2798724	-6.49	0.000	-2.364995	-1.267916

Variable	Mean	Marginal effect
MALE	0.4841	-0.0467
AGE	32.52	0.0110
S	13.31	-0.0007
ASVABC	48.94	0.0097

The means of the explanatory variables, and their marginal effects evaluated at the means, are shown in the table.

- i. Interpret the outcome from the probit model above and comment on their plausibility [15 MARKS]
- ii. The researcher considers including another dummy independent variable CHILD, defined to be 1 if the respondent had children and 0 otherwise. When the researcher does this, its z-statistic is 33.65 and its marginal effect 0.5685. Discuss these findings . [10 MARKS]

QUESTION 2

From a sample of 209 firms, Professor Simelane obtained the following regression result:

$$\log \hat{Z} = 4.32 + 0.280 \log X_1 + 0.0174 Y_2 + 0.00024 S_3$$

$$se = (0.32) \quad (0.035) \quad (0.0041) \quad (0.00054)$$

$$R^2 = 0.283$$

Where: Z = salary of CEO

X = annual firm sales

Y = return on equity in percent

S = return on firm's stock

Figures in parentheses are the estimated standard errors.

- i. Interpret the preceding regression taking into account any prior expectations that you may have about the signs of the various coefficients.
[7 MARKS]
- ii. Which of the coefficients are individually statistically significant at the 5 percent level?
[9 MARKS]
- iii. Can you interpret the coefficients of return on equity in percent (Y) and return on firm's stock (S) as elasticity coefficients? Why or why not?
[9 MARKS]

QUESTION 3

Suppose that we want to estimate a consumption function:

$$C_t = \beta_0 + \beta Y_t + \varepsilon_t$$

Where C_t = consumption, and Y_t = disposable income.

- i. Assume that we have a reason to believe that war which has been conducted in 5 of the 50 years (which is the number of observations) has affected the level of consumption. Re-specify the model by accounting for the impact of war. Discuss how to test for the impact of war.
[15 MARKS]
- ii. Suppose that we suspect that the war affected the marginal propensity to consume. Re-specify the model by accounting for impact of war. Discuss how to test for the impact of war on marginal propensity to consume.
[10 MARKS]

QUESTION 4

We wish to predict college outcomes using the following regression:

$$\text{college} = \beta_0 + \beta_1 \text{mom_college} + \beta_2 \text{dad_college} + \beta_3 \text{sibs} + u$$

Here, college is a dummy variable taking on a value of 1 for respondents with 16 or more years of education, and zero otherwise. The dummy variables mom_college and dad_college take on a value of 1 if the mom and dad went to college, respectively, and zero otherwise, sibs, which is the number of siblings of the respondent.

The results are the following:

Source	SS	df	MS	
Model	16.6200171	3	5.5400057	
Residual	135.159761	718	.188244793	
Total	151.779778	721	.210512869	

Number of obs =	722
F(3, 718) =	29.43
Prob > F =	0.0000
R-squared =	0.1095
Adj R-squared =	0.1058
Root MSE =	.43387

	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
college					
mom_college	.3245219	.0715525	XX		
dad_college	.2621026	.0646056	XX		
sibs	-.0323631	.0071906	XX		
_cons	.3497149	.0269324	XX		

- (a) Your main objective for the study you wanted to test the effect of siblings on college outcomes, please test this hypothesis at the 95% level, stating your null and alternative hypotheses. Briefly interpret your result, and show your work!!

[10 MARKS]

(b) You're unhappy with the regression above and you then further produce an interaction between sibs and parental education and now the regression model takes the following form:

$$\text{College} = \beta_0 + \beta_1 \text{mom_college} + \beta_2 \text{dad_college} + \beta_3 \text{sibs} + \beta_4 \text{mom_college} \cdot \text{sibs} + \beta_5 \text{dad_college} \cdot \text{sibs} + u$$

The outcome for this model is as presented below:

Source	SS	df	MS			
Model	17.305119	5	3.46102379	Number of obs =	722	
Residual	134.474659	716	.18781377	F(5, 716) =	18.43	
Total	151.779778	721	.210512869	Prob > F =	0.0000	
				R-squared =	0.1140	
				Adj R-squared =	0.1078	
				Root MSE =	.43337	

college	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
mom_college	.112594	.1339742	XX		
dad_college	.3460208	.1252459	XX		
mom_college_sibs	.0951133	.0523259	XX		
dad_college_sibs	-.0467353	.0497364	XX		
sibs	-.0343139	.0073956	XX		
_cons	.3561122	.0274761	XX		

Which regression is preferred, the regression in '4a' or '4b'? Please test this hypothesis at the 95% level, stating your null and alternative hypotheses. Briefly interpret your result, and show your work.

[15 MARKS]

Selected Upper Percentage Points of the F-Distribution

TABLE D.3
Upper percentage points of the F distribution (continued)

df for denom- inator N_2	df for numerator N_1												
	Pr	1	2	3	4	5	6	7	8	9	10	11	12
22	.25	1.40	1.48	1.47	1.45	1.44	1.42	1.41	1.40	1.39	1.39	1.38	1.37
	.10	2.95	2.56	2.35	2.22	2.13	2.06	2.01	1.97	1.93	1.90	1.88	1.86
	.05	4.30	3.44	3.05	2.82	2.66	2.55	2.46	2.40	2.34	2.30	2.26	2.23
	.01	7.95	5.72	4.82	4.31	3.99	3.76	3.59	3.45	3.35	3.26	3.18	3.12
24	.25	1.39	1.47	1.46	1.44	1.43	1.41	1.40	1.39	1.38	1.38	1.37	1.36
	.10	2.93	2.54	2.33	2.19	2.10	2.04	1.98	1.94	1.91	1.88	1.85	1.83
	.05	4.26	3.40	3.01	2.78	2.62	2.51	2.42	2.36	2.30	2.25	2.21	2.18
	.01	7.82	5.61	4.72	4.22	3.90	3.67	3.50	3.36	3.26	3.17	3.09	3.03
26	.25	1.38	1.46	1.45	1.44	1.42	1.41	1.39	1.38	1.37	1.37	1.36	1.35
	.10	2.91	2.52	2.31	2.17	2.08	2.01	1.96	1.92	1.88	1.86	1.84	1.81
	.05	4.23	3.37	2.98	2.74	2.59	2.47	2.39	2.32	2.27	2.22	2.18	2.15
	.01	7.72	5.53	4.64	4.14	3.82	3.59	3.42	3.29	3.18	3.09	3.02	2.96
28	.25	1.38	1.46	1.45	1.43	1.41	1.40	1.39	1.38	1.37	1.36	1.35	1.34
	.10	2.89	2.50	2.29	2.16	2.06	2.00	1.94	1.90	1.87	1.84	1.81	1.79
	.05	4.20	3.34	2.95	2.71	2.56	2.45	2.36	2.29	2.24	2.19	2.15	2.12
	.01	7.64	5.45	4.57	4.07	3.75	3.53	3.36	3.23	3.12	3.03	2.96	2.90
30	.25	1.38	1.45	1.44	1.42	1.41	1.39	1.38	1.37	1.36	1.35	1.35	1.34
	.10	2.88	2.49	2.28	2.14	2.05	1.98	1.93	1.88	1.85	1.82	1.79	1.77
	.05	4.17	3.32	2.92	2.69	2.53	2.42	2.33	2.27	2.21	2.16	2.13	2.09
	.01	7.56	5.39	4.51	4.02	3.70	3.47	3.30	3.17	3.07	2.98	2.91	2.84
40	.25	1.36	1.44	1.42	1.40	1.39	1.37	1.36	1.35	1.34	1.33	1.32	1.31
	.10	2.84	2.44	2.23	2.09	2.00	1.93	1.87	1.83	1.79	1.76	1.73	1.71
	.05	4.08	3.23	2.84	2.61	2.45	2.34	2.25	2.18	2.12	2.08	2.04	2.00
	.01	7.31	5.18	4.31	3.83	3.51	3.29	3.12	2.99	2.89	2.80	2.73	2.66
60	.25	1.35	1.42	1.41	1.38	1.37	1.35	1.33	1.32	1.31	1.30	1.29	1.29
	.10	2.79	2.39	2.18	2.04	1.95	1.87	1.82	1.77	1.74	1.71	1.68	1.66
	.05	4.00	3.15	2.76	2.53	2.37	2.25	2.17	2.10	2.04	1.99	1.95	1.92
	.01	7.08	4.98	4.13	3.65	3.34	3.12	2.95	2.82	2.72	2.63	2.56	2.50
120	.25	1.34	1.40	1.39	1.37	1.35	1.33	1.31	1.30	1.29	1.28	1.27	1.26
	.10	2.75	2.35	2.13	1.99	1.90	1.82	1.77	1.72	1.68	1.65	1.62	1.60
	.05	3.92	3.07	2.68	2.45	2.29	2.17	2.09	2.02	1.96	1.91	1.87	1.83
	.01	6.85	4.79	3.95	3.48	3.17	2.96	2.79	2.66	2.56	2.47	2.40	2.34
200	.25	1.33	1.39	1.38	1.36	1.34	1.32	1.31	1.29	1.28	1.27	1.26	1.25
	.10	2.73	2.33	2.11	1.97	1.88	1.80	1.75	1.70	1.66	1.63	1.60	1.57
	.05	3.89	3.04	2.65	2.42	2.26	2.14	2.06	1.98	1.93	1.88	1.84	1.80
	.01	6.76	4.71	3.88	3.41	3.11	2.89	2.73	2.60	2.50	2.41	2.34	2.27
∞	.25	1.32	1.39	1.37	1.35	1.33	1.31	1.29	1.28	1.27	1.25	1.24	1.24
	.10	2.71	2.30	2.08	1.94	1.85	1.77	1.72	1.67	1.63	1.60	1.57	1.55
	.05	3.84	3.00	2.60	2.37	2.21	2.10	2.01	1.94	1.88	1.83	1.79	1.75
	.01	6.63	4.61	3.78	3.32	3.02	2.80	2.64	2.51	2.41	2.32	2.25	2.18

Source: Damodar N. Gujarati, *Basic Econometrics*, Third Edition, New York: McGraw-Hill, 1995, p. 814.

Percentage Points of the t-Distribution

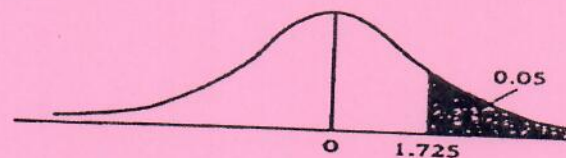
TABLE D.2
Percentage points of the *t* distribution

Example

$$\Pr(t > 2.086) = 0.025$$

$$\Pr(t > 1.725) = 0.05 \quad \text{for } df = 20$$

$$\Pr(|t| > 1.725) = 0.10$$

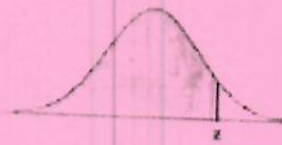


Pr df	0.25 0.50	0.10 0.20	0.05 0.10	0.025 0.05	0.01 0.02	0.005 0.010	0.001 0.002
1	1.000	3.078	6.314	12.706	31.821	63.657	318.31
2	0.816	1.886	2.920	4.303	6.965	9.925	22.327
3	0.765	1.638	2.353	3.182	4.541	5.841	10.214
4	0.741	1.533	2.132	2.776	3.747	4.604	7.173
5	0.727	1.476	2.015	2.571	3.365	4.032	5.893
6	0.718	1.440	1.943	2.447	3.143	3.707	5.208
7	0.711	1.415	1.895	2.365	2.998	3.499	4.785
8	0.706	1.397	1.860	2.306	2.896	3.355	4.501
9	0.703	1.383	1.833	2.262	2.821	3.250	4.297
10	0.700	1.372	1.812	2.228	2.764	3.169	4.144
11	0.697	1.363	1.796	2.201	2.718	3.106	4.025
12	0.695	1.356	1.782	2.179	2.681	3.055	3.930
13	0.694	1.350	1.771	2.160	2.650	3.012	3.852
14	0.692	1.345	1.761	2.145	2.624	2.977	3.787
15	0.691	1.341	1.753	2.131	2.602	2.947	3.733
16	0.690	1.337	1.746	2.120	2.583	2.921	3.686
17	0.689	1.333	1.740	2.110	2.567	2.898	3.646
18	0.688	1.330	1.734	2.101	2.552	2.878	3.610
19	0.688	1.328	1.729	2.093	2.539	2.861	3.579
20	0.687	1.325	1.725	2.086	2.528	2.845	3.552
21	0.686	1.323	1.721	2.080	2.518	2.831	3.527
22	0.686	1.321	1.717	2.074	2.508	2.819	3.505
23	0.685	1.319	1.714	2.069	2.500	2.807	3.485
24	0.685	1.318	1.711	2.064	2.492	2.797	3.467
25	0.684	1.316	1.708	2.060	2.485	2.787	3.450
26	0.684	1.315	1.706	2.056	2.479	2.779	3.435
27	0.684	1.314	1.703	2.052	2.473	2.771	3.421
28	0.683	1.313	1.701	2.048	2.467	2.763	3.408
29	0.683	1.311	1.699	2.045	2.462	2.756	3.396
30	0.683	1.310	1.697	2.042	2.457	2.750	3.385
40	0.681	1.303	1.684	2.021	2.423	2.704	3.307
60	0.679	1.296	1.671	2.000	2.390	2.660	3.232
120	0.677	1.289	1.658	1.980	2.358	2.617	3.160
∞	0.674	1.282	1.645	1.960	2.326	2.576	3.090

Note: The smaller probability shown at the head of each column is the area in one tail; the larger probability shown at the head of each column is the area in both tails.

Source: From E. S. Pearson and H. O. Hartley, eds., *Biometrika Tables for Statisticians*, vol. 1, 3d ed., Cambridge University Press, New York, 1966. Reproduced by permission of the editors and trustees of *Biometrika*.

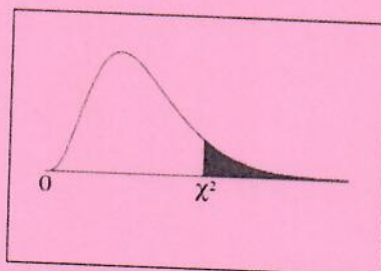
Source: Damodar N. Gujarati, *Basic Econometrics*, Third Edition, New York: McGraw-Hill, 1995, p. 809.



Normal Distribution from $-\infty$ to Z

Z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990

Chi-Square Distribution Table



The shaded area is equal to α for $\chi^2 = \chi^2_{\alpha}$.

df	$\chi^2_{.995}$	$\chi^2_{.990}$	$\chi^2_{.975}$	$\chi^2_{.950}$	$\chi^2_{.900}$	$\chi^2_{.800}$	$\chi^2_{.700}$	$\chi^2_{.600}$	$\chi^2_{.500}$	$\chi^2_{.400}$	$\chi^2_{.300}$
1	0.000	0.000	0.001	0.004	0.016	2.706	3.841	5.024	6.635	7.879	
2	0.010	0.020	0.051	0.103	0.211	4.605	5.991	7.378	9.210	10.597	
3	0.072	0.115	0.216	0.352	0.584	6.251	7.815	9.348	11.345	12.838	
4	0.207	0.297	0.484	0.711	1.064	7.779	9.488	11.143	13.277	14.860	
5	0.412	0.554	0.831	1.145	1.610	9.236	11.070	12.833	15.086	16.750	
6	0.676	0.872	1.237	1.635	2.204	10.645	12.592	14.449	16.812	18.548	
7	0.989	1.239	1.690	2.167	2.833	12.017	14.067	16.013	18.475	20.278	
8	1.344	1.646	2.180	2.733	3.490	13.362	15.507	17.535	20.090	21.955	
9	1.735	2.088	2.700	3.325	4.168	14.684	16.919	19.023	21.666	23.589	
10	2.156	2.558	3.247	3.940	4.865	15.987	18.307	20.483	23.209	25.188	
11	2.603	3.053	3.816	4.575	5.578	17.275	19.675	21.920	24.725	26.757	
12	3.074	3.571	4.404	5.226	6.304	18.549	21.026	23.337	26.217	28.300	
13	3.565	4.107	5.009	5.892	7.042	19.812	22.362	24.736	27.688	29.819	
14	4.075	4.660	5.629	6.571	7.790	21.064	23.685	26.119	29.141	31.319	
15	4.601	5.229	6.262	7.261	8.547	22.307	24.996	27.488	30.578	32.801	
16	5.142	5.812	6.908	7.962	9.312	23.542	26.296	28.845	32.000	34.267	
17	5.697	6.408	7.564	8.672	10.085	24.769	27.587	30.191	33.409	35.718	
18	6.265	7.015	8.231	9.390	10.865	25.989	28.869	31.526	34.805	37.156	
19	6.844	7.633	8.907	10.117	11.651	27.204	30.144	32.852	36.191	38.582	
20	7.434	8.260	9.591	10.851	12.443	28.412	31.410	34.170	37.566	39.997	
21	8.034	8.897	10.283	11.591	13.240	29.615	32.671	35.479	38.932	41.401	
22	8.643	9.542	10.982	12.338	14.041	30.813	33.924	36.781	40.289	42.796	
23	9.260	10.196	11.689	13.091	14.848	32.007	35.172	38.076	41.638	44.181	
24	9.886	10.856	12.401	13.848	15.659	33.196	36.415	39.364	42.980	45.559	
25	10.520	11.524	13.120	14.611	16.473	34.382	37.652	40.646	44.314	46.928	
26	11.160	12.198	13.844	15.379	17.292	35.563	38.885	41.923	45.642	48.290	
27	11.808	12.879	14.573	16.151	18.114	36.741	40.113	43.195	46.963	49.645	
28	12.461	13.565	15.308	16.928	18.939	37.916	41.337	44.461	48.278	50.993	
29	13.121	14.256	16.047	17.708	19.768	39.087	42.557	45.722	49.588	52.336	
30	13.787	14.953	16.791	18.493	20.599	40.256	43.773	46.979	50.892	53.672	
40	20.707	22.164	24.433	26.509	29.051	51.805	55.758	59.342	63.691	66.766	
50	27.991	29.707	32.357	34.764	37.689	63.167	67.505	71.420	76.154	79.490	
60	35.534	37.485	40.482	43.188	46.459	74.397	79.082	83.298	88.379	91.952	
70	43.275	45.442	48.758	51.739	55.329	85.527	90.531	95.023	100.425	104.215	
80	51.172	53.540	57.153	60.391	64.278	96.578	101.879	106.629	112.329	116.321	
90	59.196	61.754	65.647	69.126	73.291	107.565	113.145	118.136	124.116	128.299	
100	67.328	70.065	74.222	77.929	82.358	118.498	124.342	129.561	135.807	140.169	