UNIVERSITY OF LIMERICK
OLLSCOIL LUIMNIGH
FACULTY OF ARTS, HUMANITIES AND SOCIAL SCIENCES

END OF TERM ASSESSMENT PAPER

MODULE CODE: SO5041 **SEMESTER**: Autumn 2015

MODULE TITLE: Quantitative Research Methods I (MA Sociology) **EXAM DURATION**: Two hours

LECTURER: Dr. Brendan Halpin **% OF TOTAL MARKS**: 40%

EXTERNAL EXAMINER: Prof. Emer Smyth

INSTRUCTIONS TO CANDIDATES:

- Answer question 1 (40%) and two others (30% each).
- Calculators allowed: Yes
- Dictionaries allowed: Yes

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1 **Data interpretation**: (Compulsory, 40%; answer this question and two others)
Tables 1 and 2 (next page) report on attitudes to immigration, for a selection of countries, using data from Round 5 of the European Social Survey (circa 2011). Table 1 crosstabulates answers to an attitude question (relating to support for immigration by the same ethnic group as the host country), by gender for each of four countries. Table 2 breaks down the mean of this attitude variable (where 1 is "Allow many" and 4 is "Allow none") by gender and socio-economic class. The countries are Ireland, the United Kingdom, France, Germany and Sweden.

(i) Write a short report on how attitudes to immigration differ by country, gender and socio-economic class. (35%)

(ii) The attitude variable is ordinal rather than interval. What assumptions are needed to justify using its mean, as in Table 2? Is this a useful thing to do? (5%)

2 **Survey practice**: (30%)

(i) Write a short note on questionnaire design (10%)

(ii) Describe the following types of survey strategy, briefly outlining their advantages and disadvantages: (10%)

a. Simple random sample
b. Cluster sample
c. Stratified sample
d. Quota sample.

(iii) Write a short note on the problem of representativity in empirical research (10%)

Table 1: Attitudes to immigration, ESS Wave 5, selected countries by gender

Allow many/few immigrants of same race/ethnic group as majority	Gender and Country: Male DE	Male FR	Male GB	Male IE	Male SE	Male TOTAL	Female DE	Female FR	Female GB	Female IE	Female SE	Female TOTAL
Allow many to come and live here	457	99	122	201	272	1151	390	108	127	195	303	1123
	30.26	12.52	11.89	17.14	38.58	22.11	27.27	11.86	9.71	14.31	39.71	19.45
Allow some	720	420	474	520	379	2513	708	469	649	614	409	2849
	47.68	53.10	46.20	44.33	53.76	48.28	49.51	51.48	49.62	45.05	53.60	49.33
Allow a few	273	220	296	274	47	1110	271	277	364	330	44	1286
	18.08	27.81	28.85	23.36	6.67	21.33	18.95	30.41	27.83	24.21	5.77	22.27
Allow none	60	52	134	178	7	431	61	57	168	224	7	517
	3.97	6.57	13.06	15.17	0.99	8.28	4.27	6.26	12.84	16.43	0.92	8.95
TOTAL	1510	791	1026	1173	705	5205	1430	911	1308	1363	763	5775
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Allow many/few immigrants of same race/ethnic group as majority	TOTAL DE	TOTAL FR	TOTAL GB	TOTAL IE	TOTAL SE	TOTAL
Allow many to come and live here	847	207	249	396	575	2274
	28.81	12.16	10.67	15.62	39.17	20.71
Allow some	1428	889	1123	1134	788	5362
	48.57	52.23	48.11	44.72	53.68	48.83
Allow a few	544	497	660	604	91	2396
	18.50	29.20	28.28	23.82	6.20	21.82
Allow none	121	109	302	402	14	948
	4.12	6.40	12.94	15.85	0.95	8.63
TOTAL	2940	1702	2334	2536	1468	10980
	100.00	100.00	100.00	100.00	100.00	100.00

Table 2: Attitudes to immigration, ESS Wave 5, selected countries by gender and socio-economic classification: mean of score on "Allow many/few immigrants of same race/ethnic group"

European ESeC	Gender and Country: Male DE	Male FR	Male GB	Male IE	Male SE	Female DE	Female FR	Female GB	Female IE	Female SE
Large employers, higher mgrs/professiona	1.64	2.17	2.18	2.21	1.48	1.64	1.91	2.27	2.21	1.49
Lower mgrs/professionals, higher supervi	1.78	2.13	2.27	2.18	1.60	1.82	2.07	2.36	2.20	1.46
Intermediate occupations	1.82	2.00	2.27	2.10	1.47	1.88	2.20	2.30	2.48	1.62
Small employers and self-employed (non-a	2.03	2.31	2.39	2.08	1.76	2.00	2.39	2.18	2.18	1.70
Small employers and self-employed (agric	2.17	3.00	2.50	2.45	2.00	1.67	4.00	2.00	2.00	1.60
Lower supervisors and technicians	2.10	2.51	2.54	2.11	1.90	2.18	2.48	2.47	2.31	1.70
Lower sales and service	2.09	2.44	2.49	2.42	1.65	2.21	2.46	2.58	2.50	1.82
Lower technical	2.29	2.49	2.67	2.61	1.84	2.45	2.83	2.86	2.97	1.57
Routine	2.08	2.36	2.69	2.57	1.84	2.34	2.58	2.61	2.57	2.05

Both genders:

European ESeC	Country DE	FR	GB	IE	SE
Large employers, higher mgrs/professiona	1.64	2.07	2.21	2.21	1.48
Lower mgrs/professionals, higher supervi	1.80	2.10	2.33	2.20	1.52
Intermediate occupations	1.87	2.16	2.30	2.41	1.58
Small employers and self-employed (non-a	2.02	2.34	2.32	2.10	1.74
Small employers and self-employed (agric	2.07	3.50	2.47	2.42	1.90
Lower supervisors and technicians	2.12	2.50	2.51	2.22	1.83
Lower sales and service	2.18	2.45	2.57	2.48	1.78
Lower technical	2.32	2.55	2.69	2.68	1.82
Routine	2.22	2.49	2.65	2.57	1.93

Table 3: Gender and attitude to immigration, Ireland, ESSR5

Allow many/few immigrants of same race/ethnic group as majority	Gender: Male	Female	Total
Allow many to come an	201	195	396
	17.14	14.31	15.62
Allow some	520	614	1,134
	44.33	45.05	44.72
Allow a few	274	330	604
	23.36	24.21	23.82
Allow none	178	224	402
	15.17	16.43	15.85
Total	1,173	1,363	2,536
	100.00	100.00	100.00

Pearson chi2(3) = 4.1267 Pr = 0.248

3 **Hypothesis tests**: (30%)

(i) Using the same data as in Q1, Table 3 relates gender and attitude for Ireland. Describe any patterns of association evident in the table, and conduct a test of the hypothesis that attitudes differ by gender.

(ii) Paired sample t-test
The Stata output in Table 4 is drawn from the 2008 wave of the British Household Panel Survey, and relates the occupational desirability score (Hope-Goldthorpe score) of younger workers (aged under 35) to that of their father's occupation when they were aged 14. Interpret the output, and conduct a formal hypothesis test for difference.

(iii) Independent sample t-test:
The Stata output in Table 5 is based on the same sample, but compares occupational desirability score across the genders. Interpret the output; conduct a formal hypothesis test for difference; and explain how this t-test (male vs female) formally differs from the previous one (self vs father).

Table 4: Comparing own and father's HGS score for younger workers

```
. ttest rmrjhgs == pahgs if rage<35

Paired t test
------------------------------------------------------------------------------
Variable |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
 rmrjhgs |   1,146    50.24924    .4418862    14.95901    49.38224    51.11624
   pahgs |   1,146    48.75193    .4591477    15.54335    47.85106    49.65279
---------+--------------------------------------------------------------------
    diff |   1,146    1.497312    .5668808     19.1904    .3850706    2.609554
------------------------------------------------------------------------------
     mean(diff) = mean(rmrjhgs - pahgs)                            t =   2.6413
 Ho: mean(diff) = 0                             degrees of freedom =     1145

 Ha: mean(diff) < 0           Ha: mean(diff) != 0           Ha: mean(diff) > 0
 Pr(T < t) = 0.9958         Pr(|T| > |t|) = 0.0084          Pr(T > t) = 0.0042
```

Table 5: Comparing HGS score across genders, for younger workers

```
. ttest rmrjhgs if rage<35, by(sex)

Two-sample t test with equal variances
------------------------------------------------------------------------------
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
    male |     537    50.98333    .6324614    14.65619    49.74093    52.22574
  female |     609    49.60194    .6160819    15.20362    48.39203    50.81184
---------+--------------------------------------------------------------------
combined |   1,146    50.24924    .4418862    14.95901    49.38224    51.11624
---------+--------------------------------------------------------------------
    diff |            1.381396    .8849668               -.3549444    3.117736
------------------------------------------------------------------------------
    diff = mean(male) - mean(female)                              t =   1.5610
Ho: diff = 0                                   degrees of freedom =     1144

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.9406         Pr(|T| > |t|) = 0.1188          Pr(T > t) = 0.0594
```

Table 6: Regression relating third level to second level performance

Source	SS	df	MS	Number of obs	=	1,736
				F(1, 1734)	=	590.72
Model	92.4717624	1	92.4717624	Prob > F	=	0.0000
Residual	271.443029	1,734	.156541539	R-squared	=	0.2541
				Adj R-squared	=	0.2537
Total	363.914791	1,735	.209749159	Root MSE	=	.39565

qcaval	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
cao	.0038835	.0001598	24.30	0.000	.0035701	.0041969
_cons	.9680034	.0727607	13.30	0.000	.8252955	1.110711

4 **Regression analysis**: (30%)

Table 6 reports a regression analysis based on a random sample of UL students. It predicts their QCA (0-4 scale of cumulative performance in UL) by their Leaving Cert points (CAO score, range c250-600).

(i) Report and interpret the regression equation, $Y = a + bX$.

(ii) Predict performance if CAO points are 200, 400, and 550.

(iii) Graph the regression line.

(iv) Formally test the hypothesis that CAO points are related to performance in university.

(v) How well does this relationship fit?

(vi) Is second level performance (captured by Leaving Cert points) by itself an adequate predictor of third level performance? What other things need to be taken in to account, and how would they be likely to modify the analysis?

Formulas and Tables

(a) Standard deviation:

$$\sigma = \sqrt{\frac{\sum (X_i - \bar{X})^2}{n-1}}$$

(b) z-score: If X is drawn from a normal distribution, with mean μ, and standard deviation σ, its corresponding z-score is:

$$z = \frac{X - \mu}{\sigma}$$

(c) Standard deviation for a proprortion, π:

$$\sigma_\pi = \sqrt{\pi(1-\pi)}$$

(d) Sample standard error, SE, depends on sample standard deviation, s, and sample size, n:

$$SE = \frac{s}{\sqrt{n}}$$

(e) Confidence interval around point estimate, ε, where z is the z-score for the required level of confidence, and SE the standard error (note: z-score may be derived from standard normal distribution or t-distribution, as appropriate):

$$\varepsilon \pm z \times SE$$

(f) Chi-squared statistic for a table,

$$X^2 = \sum \frac{(O-E)^2}{E}$$

where O is the observed value and E the expected value.

(g) Expected value under independence in a table:

$$E = \frac{rc}{T}$$

where r is the row total and c the column total for that cell, and T the grand total for the table.

(h) Predicted value from a bi-variate regression, where a is the constant and b the slope coefficient:

$$\hat{Y} = a + bx$$

(i) Standard error for comparing means of two sub-samples, whose variance may not be the same:

$$\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$$

where s_i is the standard deviation for group i, and n_i the number of cases in group i.

Table of the Standard Normal Distribution

Right tail (probability of $X > z$)

	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
.00	.5000	.4960	.4920	.4880	.4840	.4801	.4761	.4721	.4681	.4641
.10	.4602	.4562	.4522	.4483	.4443	.4404	.4364	.4325	.4286	.4247
.20	.4207	.4168	.4129	.4090	.4052	.4013	.3974	.3936	.3897	.3859
.30	.3821	.3783	.3745	.3707	.3669	.3632	.3594	.3557	.3520	.3483
.40	.3446	.3409	.3372	.3336	.3300	.3264	.3228	.3192	.3156	.3121
.50	.3085	.3050	.3015	.2981	.2946	.2912	.2877	.2843	.2810	.2776
.60	.2743	.2709	.2676	.2643	.2611	.2578	.2546	.2514	.2483	.2451
.70	.2420	.2389	.2358	.2327	.2296	.2266	.2236	.2206	.2177	.2148
.80	.2119	.2090	.2061	.2033	.2005	.1977	.1949	.1922	.1894	.1867
.90	.1841	.1814	.1788	.1762	.1736	.1711	.1685	.1660	.1635	.1611
1.00	.1587	.1562	.1539	.1515	.1492	.1469	.1446	.1423	.1401	.1379
1.10	.1357	.1335	.1314	.1292	.1271	.1251	.1230	.1210	.1190	.1170
1.20	.1151	.1131	.1112	.1093	.1075	.1056	.1038	.1020	.1003	.0985
1.30	.0968	.0951	.0934	.0918	.0901	.0885	.0869	.0853	.0838	.0823
1.40	.0808	.0793	.0778	.0764	.0749	.0735	.0721	.0708	.0694	.0681
1.50	.0668	.0655	.0643	.0630	.0618	.0606	.0594	.0582	.0571	.0559
1.60	.0548	.0537	.0526	.0516	.0505	.0495	.0485	.0475	.0465	.0455
1.70	.0446	.0436	.0427	.0418	.0409	.0401	.0392	.0384	.0375	.0367
1.80	.0359	.0351	.0344	.0336	.0329	.0322	.0314	.0307	.0301	.0294
1.90	.0287	.0281	.0274	.0268	.0262	.0256	.0250	.0244	.0239	.0233
2.00	.0228	.0222	.0217	.0212	.0207	.0202	.0197	.0192	.0188	.0183
2.10	.0179	.0174	.0170	.0166	.0162	.0158	.0154	.0150	.0146	.0143
2.20	.0139	.0136	.0132	.0129	.0125	.0122	.0119	.0116	.0113	.0110
2.30	.0107	.0104	.0102	.0099	.0096	.0094	.0091	.0089	.0087	.0084
2.40	.0082	.0080	.0078	.0075	.0073	.0071	.0069	.0068	.0066	.0064
2.50	.0062	.0060	.0059	.0057	.0055	.0054	.0052	.0051	.0049	.0048
2.60	.0047	.0045	.0044	.0043	.0041	.0040	.0039	.0038	.0037	.0036
2.70	.0035	.0034	.0033	.0032	.0031	.0030	.0029	.0028	.0027	.0026
2.80	.0026	.0025	.0024	.0023	.0023	.0022	.0021	.0021	.0020	.0019
2.90	.0019	.0018	.0018	.0017	.0016	.0016	.0015	.0015	.0014	.0014
3.00	.0013	.0013	.0013	.0012	.0012	.0011	.0011	.0011	.0010	.0010
3.10	.0010	.0009	.0009	.0009	.0008	.0008	.0008	.0008	.0007	.0007
3.20	.0007	.0007	.0006	.0006	.0006	.0006	.0006	.0005	.0005	.0005
3.30	.0005	.0005	.0005	.0004	.0004	.0004	.0004	.0004	.0004	.0003
3.40	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0002
3.50	.0002	.0002	.0002	.0002	.0002	.0002	.0002	.0002	.0002	.0002
3.60	.0002	.0002	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001
3.70	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001
3.80	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001
3.90	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
4.00	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000

Table of Student's *t* Distribution

Two-tailed probability

Degrees of Freedom	Probability level (Area under both tails)				
	0.10	0.05	0.025	0.01	0.005
1	6.314	12.706	25.452	63.657	127.321
2	2.920	4.303	6.205	9.925	14.089
3	2.353	3.182	4.177	5.841	7.453
4	2.132	2.776	3.495	4.604	5.598
5	2.015	2.571	3.163	4.032	4.773
6	1.943	2.447	2.969	3.707	4.317
7	1.895	2.365	2.841	3.499	4.029
8	1.860	2.306	2.752	3.355	3.833
9	1.833	2.262	2.685	3.250	3.690
10	1.812	2.228	2.634	3.169	3.581
11	1.796	2.201	2.593	3.106	3.497
12	1.782	2.179	2.560	3.055	3.428
13	1.771	2.160	2.533	3.012	3.372
14	1.761	2.145	2.510	2.977	3.326
15	1.753	2.131	2.490	2.947	3.286
16	1.746	2.120	2.473	2.921	3.252
17	1.740	2.110	2.458	2.898	3.222
18	1.734	2.101	2.445	2.878	3.197
19	1.729	2.093	2.433	2.861	3.174
20	1.725	2.086	2.423	2.845	3.153
21	1.721	2.080	2.414	2.831	3.135
22	1.717	2.074	2.405	2.819	3.119
23	1.714	2.069	2.398	2.807	3.104
24	1.711	2.064	2.391	2.797	3.091
25	1.708	2.060	2.385	2.787	3.078
26	1.706	2.056	2.379	2.779	3.067
27	1.703	2.052	2.373	2.771	3.057
28	1.701	2.048	2.368	2.763	3.047
29	1.699	2.045	2.364	2.756	3.038
30	1.697	2.042	2.360	2.750	3.030
35	1.690	2.030	2.342	2.724	2.996
40	1.684	2.021	2.329	2.704	2.971
50	1.676	2.009	2.311	2.678	2.937
60	1.671	2.000	2.299	2.660	2.915
75	1.665	1.992	2.287	2.643	2.892
100	1.660	1.984	2.276	2.626	2.871
500	1.648	1.965	2.248	2.586	2.820
1000	1.646	1.962	2.245	2.581	2.813
100000	1.645	1.960	2.241	2.576	2.807

Table of the χ^2 distribution (chi-sq)

Values of the χ^2 statistic for various degrees of freedom and areas under the right tail

Degrees of Freedom	Area under right tail				
	0.100	0.050	0.025	0.010	0.005
1	2.706	3.841	5.024	6.635	7.879
2	4.605	5.991	7.378	9.210	10.597
3	6.251	7.815	9.348	11.345	12.838
4	7.779	9.488	11.143	13.277	14.860
5	9.236	11.070	12.833	15.086	16.750
6	10.645	12.592	14.449	16.812	18.548
7	12.017	14.067	16.013	18.475	20.278
8	13.362	15.507	17.535	20.090	21.955
9	14.684	16.919	19.023	21.666	23.589
10	15.987	18.307	20.483	23.209	25.188
11	17.275	19.675	21.920	24.725	26.757
12	18.549	21.026	23.337	26.217	28.300
13	19.812	22.362	24.736	27.688	29.819
14	21.064	23.685	26.119	29.141	31.319
15	22.307	24.996	27.488	30.578	32.801
16	23.542	26.296	28.845	32.000	34.267
17	24.769	27.587	30.191	33.409	35.718
18	25.989	28.869	31.526	34.805	37.156
19	27.204	30.144	32.852	36.191	38.582
20	28.412	31.410	34.170	37.566	39.997
21	29.615	32.671	35.479	38.932	41.401
22	30.813	33.924	36.781	40.289	42.796
23	32.007	35.172	38.076	41.638	44.181
24	33.196	36.415	39.364	42.980	45.559
25	34.382	37.652	40.646	44.314	46.928