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

END OF TERM ASSESSMENT PAPER

MODULE CODE: SO5041 **SEMESTER**: Autumn 2016

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)
See Tables 1, 2 and 3 on the following pages (Stata output). They relate income to social class and gender (Table 1), income to education and gender (Table 2) and relate social class and education to each other (Table 3. Use the information in these tables to write a short report on the relative importance of these three factors for income (data is drawn from Wave 18 of the British Household Panel Study, for respondents aged 25-54).

Table 1: Social class and gender: mean monthly income and number of cases

Goldthorpe Social Class	sex		
	male	female	Total
Professional/managerial	3253.58	2309.68	2772.50
	1,115	1,159	2,274
Routine non-manual	1756.89	1288.51	1371.75
	161	745	906
Self-employed & employers	1737.69	1150.56	1567.30
	203	83	286
Farmers and farm labourers	2271.96	1296.13	2072.44
	428	110	538
Skilled and supervisory	1734.60	1066.85	1478.89
	340	211	551
Semi- and unskilled	1664.49	1468.57	1599.18
	30	15	45
Total	2580.34	1774.46	2173.37
	2,277	2,323	4,600

Table 2: Education and gender: mean monthly income and number of cases

Highest Educational Qualification	sex		
	male	female	Total
Third level	2806.31	1984.44	2392.14
	1,512	1,536	3,048
Complete 2nd	2262.67	1435.65	1839.58
	253	265	518
Incomplete 2nd	2024.78	1369.70	1683.70
	406	441	847
Low or none	2243.20	1104.70	1750.06
	106	81	187
Total	2580.34	1774.46	2173.37
	2,277	2,323	4,600

Table 3: Social class and education (column percentages)

Goldthorpe Social Class	Highest Educational Qualification				
	Third lev	Complete	Incomplet	Low or no	Total
Professional/manageri	1,837	198	218	21	2,274
	60.27	38.22	25.74	11.23	49.43
Routine non-manual	517	144	207	38	906
	16.96	27.80	24.44	20.32	19.70
Self-employed & emplo	143	40	83	20	286
	4.69	7.72	9.80	10.70	6.22
Farmers and farm labo	296	64	143	35	538
	9.71	12.36	16.88	18.72	11.70
Skilled and superviso	230	67	183	71	551
	7.55	12.93	21.61	37.97	11.98
Semi- and unskilled	25	5	13	2	45
	0.82	0.97	1.53	1.07	0.98
Total	3,048	518	847	187	4,600
	100.00	100.00	100.00	100.00	100.00

2 **Generalisability**: (30%)
Write a short note on the importance of generalisability in social research. Make reference to the influence of sampling strategy and survey practice on generalisation.

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

(i) Construct a 95% confidence interval around the mean of the following small data set:

$$\mathbf{X} = (16, 13, 10, 4, 7, 12, 9, 11, 4, 6)$$

(ii) The following Stata analysis uses the same data as Question 1, and tests whether income differs across gender. Interpret the output and show how to test the hypothesis that income differs by gender.

```
Two-sample t test with equal variances
------------------------------------------------------------------------------
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
    male |   2,277    2580.344    44.11902    2105.268    2493.826    2666.861
  female |   2,323    1774.459     23.1932    1117.855    1728.978    1819.941
---------+--------------------------------------------------------------------
combined |   4,600    2173.372    25.48113    1728.214    2123.417    2223.327
---------+--------------------------------------------------------------------
    diff |            805.8844    49.56541                708.7124    903.0564
------------------------------------------------------------------------------
    diff = mean(male) - mean(female)                              t =  16.2590
Ho: diff = 0                                     degrees of freedom =     4598

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 1.0000         Pr(|T| > |t|) = 0.0000          Pr(T > t) = 0.0000
```

(iii) Use the data in the following output to conduct a test of the hypothesis that wages differ by union status:

```
. tab union, su(wage)

      union |       Summary of hourly wage
     worker |        Mean   Std. Dev.       Freq.
------------+------------------------------------
   nonunion |   7.2046688   4.1036938       1,417
      union |   8.6742941   4.1745389         461
------------+------------------------------------
      Total |   7.5654235   4.1683693       1,878
```

4 **Regression analysis**: (30%)
Table 4 reports a regression analysis, predicting average religiosity score from survey data from 17 countries in 1998, with their score in 1991. The data are plotted in Figure 1: the steep line indicates where the 1998 and 1991 scores are the same, while the shallower line is the regression prediction.

(i) Interpret the graphic: what can you say about change in average religiosity in this period?
(ii) Report the regression equation and interpret it in words
(iii) Predict the 1998 score for 1991 scores of 1 and 2.75
(iv) Test the hypothesis that the 1991 score has an effect on the 1998 score
(v) Report and interpret the R^2

Table 4: Social class, gender and income

```
. reg v1998 v1991

      Source |       SS           df       MS      Number of obs   =        17
-------------+----------------------------------   F(1, 15)        =     18.26
       Model |  1.22709207         1  1.22709207   Prob > F        =    0.0007
    Residual |  1.00829187        15  .067219458   R-squared       =    0.5489
-------------+----------------------------------   Adj R-squared   =    0.5189
       Total |  2.23538394        16  .139711496   Root MSE        =    .25927

------------------------------------------------------------------------------
       v1998 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       v1991 |   .5966598   .1396483     4.27   0.001     .2990064    .8943131
       _cons |   .7048336   .2869952     2.46   0.027     .0931177    1.316549
------------------------------------------------------------------------------
```

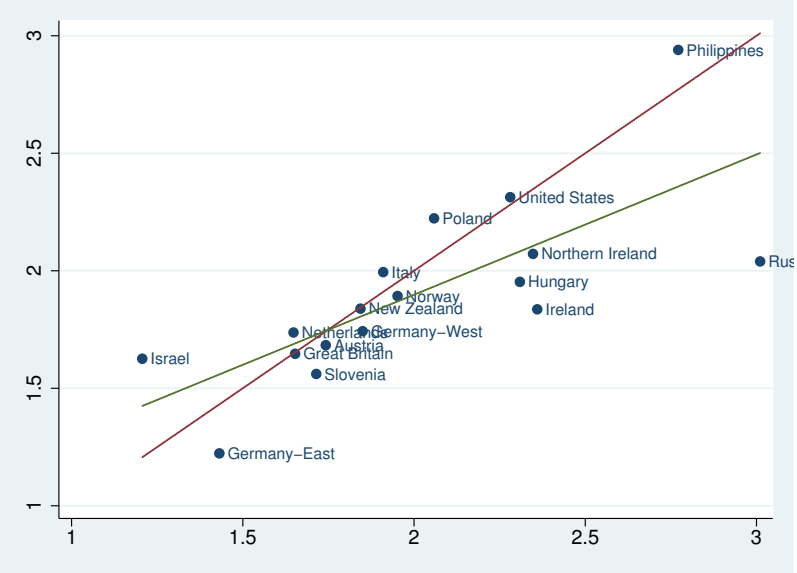

Figure 1: Regression of religiosity score in 1998 on score in 1991, 17 countries

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