UNIVERSITY OF LIMERICK
OLLSCOIL LUIMNIGH
COLLEGE OF HUMANITIES

END OF TERM ASSESSMENT PAPER

MODULE CODE: SO5041 **SEMESTER**: Autumn 2011

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

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

EXTERNAL EXAMINER: Prof. Chris Whelan

INSTRUCTIONS TO CANDIDATES:

- Answer four questions: all questions carry ten points each
- Calculators allowed: Yes
- Dictionaries allowed: Yes

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1 The distribution of the time (in minutes) that interviews took, in round 4 of the European Social Survey in Ireland, is summarised here:

```
. su inwtm if cntry=="IE"

    Variable |       Obs        Mean    Std. Dev.       Min        Max
-------------+--------------------------------------------------------
       inwtm |      1683      66.265    21.11226          25        210
```

(i) Assuming that the interview time is normally distributed (with the reported mean and standard deviation) answer the following questions (7.5 points):

a. What proportion of interviews took less than one hour?
b. How many interviews took more than 45 minutes?
c. What proportion took between 50 and 75 minutes?
d. How many interviews took less than 25 minutes?
e. What interview duration represents the 75th percentile?

(ii) Consider the histogram of the same variable in Figure 1 and the following summary:

```
. centile  inwtm if cntry=="IE", centile(25 50 75)

                                                  -- Binom. Interp. --
    Variable |     Obs  Percentile      Centile        [95% Conf. Interval]
-------------+-------------------------------------------------------------
       inwtm |    1683          25            53              52          54
             |                  50            64              62          64
             |                  75            76              75          77
```

How justified is the assumption that the distribution is normal? In what respect does this information disagree with your answers above? (2.5 points)

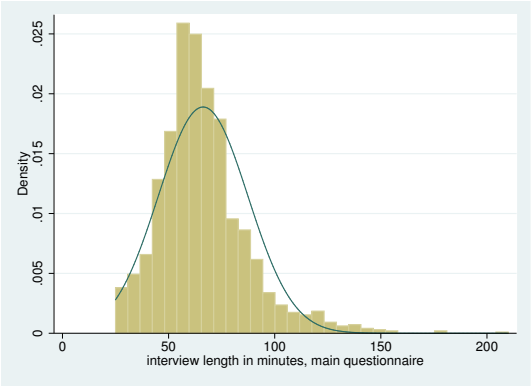

Figure 1: Histogram of interview time

Table 1: Gender and religious belonging, ESS4, by country, all ages (see Q2)

Country	Belongs to a religious denomination			
	Male		Female	
	Yes	No	Yes	No
Bulgaria	728	247	1067	182
	(74.67)	(25.33)	(85.43)	(14.57)
Cyprus	597	7	599	2
	(98.84)	(1.16)	(99.67)	(0.33)
Germany	737	709	743	551
	(50.97)	(49.03)	(57.42)	(42.58)
Denmark	435	363	523	286
	(54.51)	(45.49)	(64.65)	(35.35)
France	404	535	598	526
	(43.02)	(56.98)	(53.20)	(46.80)
UK	444	627	663	607
	(41.46)	(58.54)	(52.20)	(47.80)
Ireland	641	167	777	175
	(79.33)	(20.67)	(81.62)	(18.38)
Israel	1128	12	1330	20
	(98.95)	(1.05)	(98.52)	(1.48)
Norway	432	374	437	304
	(53.60)	(46.40)	(58.97)	(41.03)
Poland	695	64	786	64
	(91.57)	(8.43)	(92.47)	(7.53)
Sweden	254	663	316	595
	(27.70)	(72.30)	(34.69)	(65.31)

Table 2: Gender and religious belonging, ESS4, by country, those aged under 30

Country	Belongs to a religious denomination			
	Male		Female	
	Yes	No	Yes	No
Bulgaria	96	40	140	36
	(70.59)	(29.41)	(79.55)	(20.45)
Cyprus	136	1	161	0
	(99.27)	(0.73)	(100.00)	(0.00)
Germany	102	161	92	111
	(38.78)	(61.22)	(45.32)	(54.68)
Denmark	52	81	61	63
	(39.10)	(60.90)	(49.19)	(50.81)
France	48	116	66	143
	(29.27)	(70.73)	(31.58)	(68.42)
UK	50	114	87	153
	(30.49)	(69.51)	(36.25)	(63.75)
Ireland	99	53	110	47
	(65.13)	(34.87)	(70.06)	(29.94)
Israel	337	2	342	4
	(99.41)	(0.59)	(98.84)	(1.16)
Norway	84	88	95	76
	(48.84)	(51.16)	(55.56)	(44.44)
Poland	214	22	203	22
	(90.68)	(9.32)	(90.22)	(9.78)
Sweden	50	170	47	122
	(22.73)	(77.27)	(27.81)	(72.19)

2 The European Social Survey asks respondents whether they belong to any religious denomination. Tables 1 and 2 report numbers saying yes and no, by gender, for a selection of countries. Table 1 is for the whole population and Table 2 is for those under 30. Interpret the patterns in the table, and write a short report about the relationships between religiosity, gender and country.

Feel free to speculate about explanations for the patterns, but give priority to the information you can read form the tables.

3 Education researchers think that familiarity with assessment format has a big impact on performance. To test this they give a group of 16 students an assessment using a novel multiple-choice format. Two weeks later they give the same students another test in the same format. The students' marks are below.

ID	Test 1	Test 2
1.	40	71
2.	59	44
3.	24	56
4.	38	61
5.	51	60
6.	46	56
7.	54	50
8.	54	68
9.	34	75
10.	50	29
11.	32	62
12.	59	72
13.	58	53
14.	20	68
15.	44	50
16.	52	57

(i) Formulate this as a statistical hypothesis test, carry out the test and interpret the result. (7 points)

(ii) What does this test tell us in respect of the initial research question? (3 points)

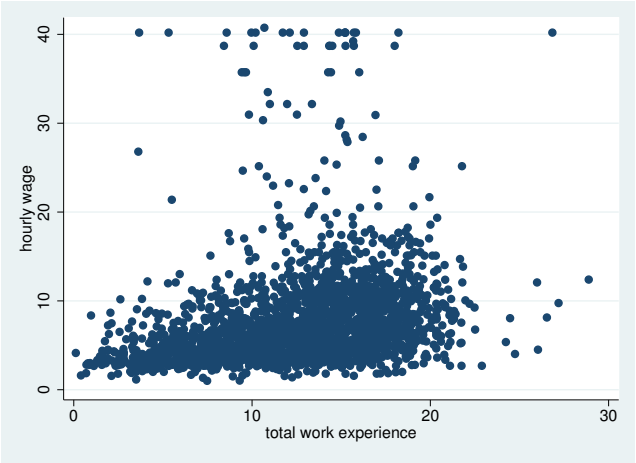

Figure 2: Scatterplot of wage and total work experience, NLSW88.

4 The US National Longitudinal Study of Women (1988, for women aged 34 to 46) contains information on, *inter alia*, hourly wage rate and total life-time work experience. Figure 2 is a scatter plot of wage by experience, and the following output summarised the relationship as a regression with experience predicting wage rate.

```
. reg wage ttl

      Source |       SS       df       MS              Number of obs =    2246
-------------+------------------------------           F(  1,  2244) =  170.14
       Model |  5241.29609     1  5241.29609            Prob > F      =  0.0000
    Residual |  69126.6713  2244   30.805112           R-squared     =  0.0705
-------------+------------------------------           Adj R-squared =  0.0701
       Total |  74367.9674  2245  33.1260434           Root MSE      =  5.5502

------------------------------------------------------------------------------
        wage |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     ttl_exp |   .3314291   .0254087    13.04   0.000     .2816021    .3812562
       _cons |   3.612492   .3393469    10.65   0.000     2.947026    4.277959
------------------------------------------------------------------------------
```

(i) Describe the patterns visible in the scatter plot. Is there a strong relationship between the variables? What form does the relationship (strong or weak) take?

(ii) From the regression output, summarise in words the effect of experience on wage.

(iii) Predict wage for someone with (1) 2 years experience, and (2) 20 years experience

(iv) Conduct a hypothesis test with respect to the effect of experience on wage.

(v) Report and discuss R^2, and relate it to the result of your hypothesis test.

5 An organisation wishes to fund a survey on the effect of social class on educational attainment. Assuming you have full responsiblility for designing the research, outline how you would propose to go about it. Address issues such as operationalisation of the research question, sampling, questionnaire design, and survey delivery (e.g., self completion by mail, or online, versus by interviewer), discussing advantages and disadvantages.

6 The following table relates the stage at which school leavers left second level, with their employment status 18 months after. Study the table carefully and answer the following questions:

Table 3: Crosstabulation of stage at which education left, and current employment status, 18 months after leaving second level

Last stage of education	Usual Employment Situation					
	Working	Unemployed	Looking 1st job	Student	Other	Total
Completed Leaving	579	69	190	940	20	1798
	(32.20)	(3.84)	(10.57)	(52.28)	(1.11)	(100.00)
Studying for Leaving	35	15	11	6	3	70
	(50.00)	(21.43)	(15.71)	(8.57)	(4.29)	(100.00)
Completed Transition Year	42	3	20	6	1	72
	(58.33)	(4.17)	(27.78)	(8.33)	(1.39)	(100.00)
Completed Senior Cert	65	14	38	5	3	125
	(52.00)	(11.20)	(30.40)	(4.00)	(2.40)	(100.00)
Completed Junior Cert	10	7	15	2	1	35
	(28.57)	(20.00)	(42.86)	(5.71)	(2.86)	(100.00)
No Exam	37	5	47	2	6	97
	(38.14)	(5.15)	(48.45)	(2.06)	(6.19)	(100.00)
Total	768	113	321	961	34	2197
	(34.96)	(5.14)	(14.61)	(43.74)	(1.55)	(100.00)

Row percentages in parentheses.
Drawn from ESRI 1993 School Leavers' Survey.

(i) Describe the main features of the association between stage left and current employment status.

(ii) Discuss these features, and speculate about the reasons for them.

(iii) The Pearson Chi-squared (χ^2) figure for the table is 427.8. Using the attached χ^2 table, explain what this figure tells us.

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

Degrees of Freedom	Two-tailed probability: 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