

EXAMINATIONS OF THE ROYAL STATISTICAL SOCIETY

HIGHER CERTIFICATE IN STATISTICS, 2017

MODULE 1 : Data collection and interpretation

Time allowed: One and a half hours

*Candidates should answer **THREE** questions.*

Each question carries 20 marks.

The number of marks allotted for each part-question is shown in brackets.

Graph paper and Official tables are provided.

Candidates may use calculators in accordance with the regulations published in the Society's "Guide to Examinations" (document Ex1).

The notation \log denotes logarithm to base e .

Logarithms to any other base are explicitly identified, e.g. \log_{10} .

Note also that $\binom{n}{r}$ is the same as nC_r .

This examination paper consists of 8 printed pages.

This front cover is page 1.

Question 1 starts on page 2.

There are 4 questions altogether in the paper.

1. The table below shows how support by voters for the main political parties in England in 2015 varied with a range of demographic factors. Voters are classified by sex, age group, socio-economic group, location, and ethnicity. Each figure given is an index showing support by a group for a party. A figure of 100 indicates that support is at the national average level; a figure of 105 shows that support is 5% higher than the national average level; a figure of 90 indicates that support is 10% less than the national average level. (The socio-economic group AB is upper middle class and middle class, C1 is lower middle class, C2 is skilled working class, DE is working class and those at the lowest level of subsistence.)

	Green	Labour	Liberal Democrat	Conservative	UKIP
Male	82	96	106	97	117
Female	122	105	92	103	79
18–24	227	120	92	92	36
25–34	122	140	119	72	36
35–44	104	129	111	76	77
45–54	78	99	91	91	128
55–64	76	88	93	111	114
65+	75	65	91	130	139
AB	98	83	138	117	79
C1	118	98	88	105	92
C2	84	109	87	90	122
DE	98	116	75	80	117
Urban	102	108	100	93	97
Rural	98	72	100	123	113
White	102	93	102	104	106
Non-White	59	195	64	56	19

Source: Populus (an opinion polling company)

- (i) Summarise how sex is related to political party preference in the data. Draw a suitable graph, or graphs, to illustrate your answer. (4)
- (ii) The political parties are shown in order from what are generally considered to be the most left wing (Green) to most right wing (UKIP). Identify the main patterns in political preferences as they vary by age. Draw a suitable graph, or graphs, to illustrate your answer. (6)

- (iii) Of the sixteen categories in the table identify that with profile most like the national average, and that with profile least like the national average. Discuss briefly why these groups might be expected to have such profiles. (4)
- (iv) Show that about 60% of Green supporters are female. Find the corresponding percentage for UKIP supporters. State any assumptions that you have made in answering those questions. (4)
- (v) A newspaper article noted the figures of 92 for the level of support among people in the 18–24 age range for the Liberal Democrats and for the Conservatives. The article stated that support in this age-group was evenly split between these two parties. Explain why that is the wrong conclusion to draw from the data, and state the correct conclusion. (2)

2. Each of the following is a possible but unsatisfactory item on a questionnaire. In each case state the problem (or problems) with the item and give or describe a new version that avoids the problem (or problems).

(a) Rate the speed and accuracy with which you work, compared with your colleagues, on the following scale.

Above average Average Below average
(2)

(b) How far is it, in miles, from your home to your place of work?
(2)

(c) What is your favourite leisure activity?
Watching TV Using a computer Playing games Other
(2)

(d) Where do you like to go on holiday?
In Britain Somewhere in Europe Elsewhere in the world
(2)

(e) Please state your annual income.
(2)

(f) How often do you exercise?
Every day Two or three times a week Two or three times a month Never
(2)

(g) To what extent do you agree with the statement that we should reduce welfare spending in this country?
Completely agree Somewhat agree Somewhat disagree Completely disagree
(2)

(h) What type of computer operating system do you use?
MacOS Windows Linux
(2)

(i) What percentage of your household budget do you spend on food and drink?
(2)

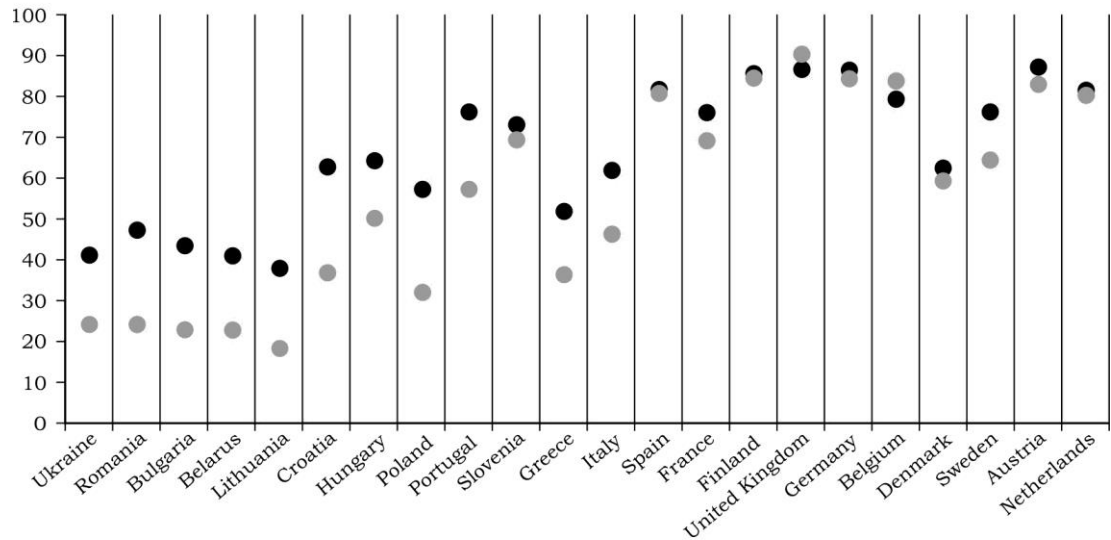
(j) *Addressed to a pregnant woman:* Do you smoke?
Yes No
(2)

3. (a) The chart below shows, for 22 countries, the level of happiness for citizens aged 15 to 74 and for those aged 75 and over. The countries are, from left to right, in increasing order of GDP per capita.

Experienced Happiness by GDP Per Capita and Age

Countries are sorted by GDP per capita (from the lowest to the highest)

● 15 to 74 ● 75+

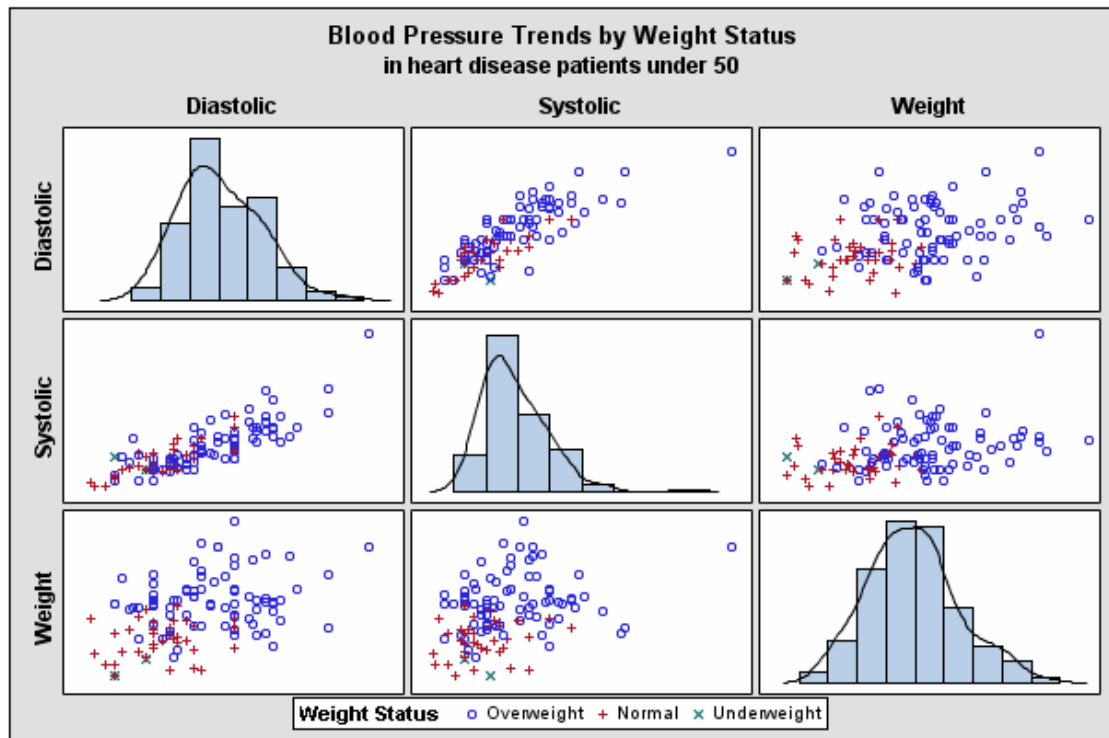


Surveys conducted between 2005 and 2010. Results for countries where sample sizes drop below 100 for those 75 and older are not reported.

- (i) Comment briefly on the strengths and weaknesses of the way in which the data are presented. (4)
- (ii) Summarise in words the main messages in these data. (4)
- (iii) Identify the additional information you would wish to have in order to be able to interpret these data better. (2)

Question 3 continued on next page

- (b) The chart below shows, for a group of heart disease patients, the distributions of their weights, their diastolic blood pressures, and their systolic blood pressures. It also shows scatter plots for each pair of variables.



- (i) Comment on the strengths and weaknesses of the ways in which the data are displayed. (4)
- (ii) Identify the additional information you would wish to have in order to interpret these data better. (2)
- (iii) Discuss what useful conclusions, if any, can be drawn from
- (A) the histograms,
 - (B) the scatter plots. (4)

4. The table below shows road traffic accident statistics for a European country from 2004–2013. Four of the columns are labelled (A) to (D) for later reference.

Year	Number of accidents (A)	Number involving death or injury (B)	Number of persons killed (C)	Number of persons injured (D)
2004	537 000	77 000	4427	136 000
2005	621 000	87 000	4505	154 000
2006	729 000	96 000	4633	169 000
2007	826 000	107 000	5007	189 000
2008	950 000	104 000	4236	184 000
2009	1 053 000	111 000	4324	201 000
2010	1 106 000	117 000	4045	211 000
2011	1 229 000	132 000	3835	238 000
2012	1 297 000	154 000	3750	268 000
2013	1 207 000	161 000	3685	275 000

- (i) Describe the trends shown in each of columns (A) to (D). Explain why these trends, taken individually, give only limited useful information. (6)
- (ii) Draw a graph to show the trend in the number of persons killed per thousand accidents. Describe this trend in words, say what it indicates about road safety, and discuss possible underlying causes. (8)
- (iii) Investigate the trend in the number of persons killed relative to the number of persons injured. Discuss what, if anything, this trend adds to your conclusions in part (ii). (6)

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