

S

93201Q



NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

Scholarship 2014 Statistics

9.30 am Wednesday 12 November 2014
Time allowed: Three hours
Total marks: 40

QUESTION BOOKLET

There are FIVE questions in this booklet. Answer ALL questions.

Pull out Formulae and Tables Booklet S–STATF from the centre of this booklet.

Write your answers in Answer Booklet 93201A.

Show ALL working. Start your answer to each question on a new page. Carefully number each question.

Check that this booklet has pages 2–13 in the correct order and that none of these pages is blank.

YOU MAY KEEP THIS BOOKLET AT THE END OF THE EXAMINATION.

QUESTION ONE (8 marks)

The graphs in Figures 1, 2 and 3 below have been prepared from data gathered from the World Health Organization and World Fact Book. The variables, for 70 countries, are:

- the percentage of the adult population who are classified as obese (obesity rate)
- the percentage of the adult population with diabetes (diabetic rate)
- life expectancy (years)
- Gross Domestic Product (GDP) per capita (in tens of thousands of dollars). GDP can be considered a measure of the wealth of the country.

A regression line has been fitted to the data in each figure, and the equation of the line is shown.

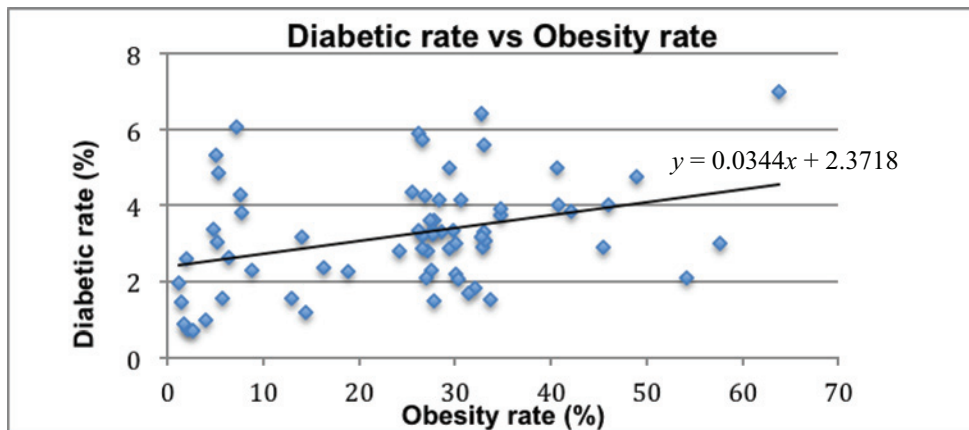


Figure 1

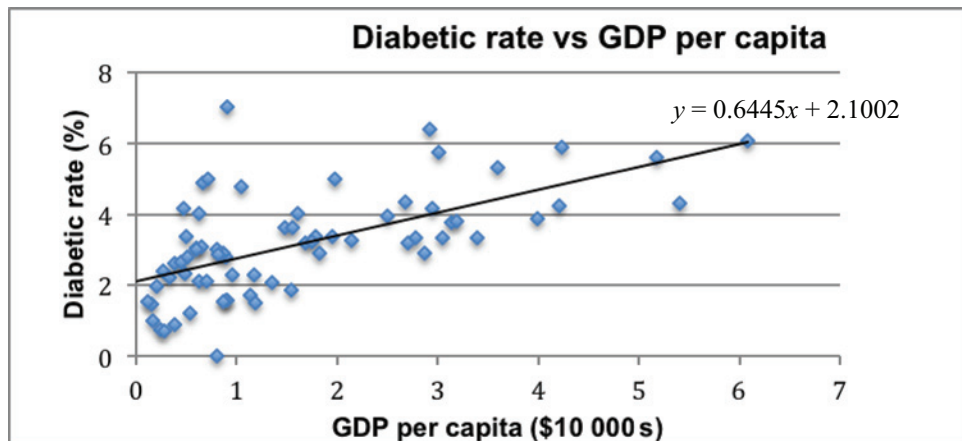


Figure 2

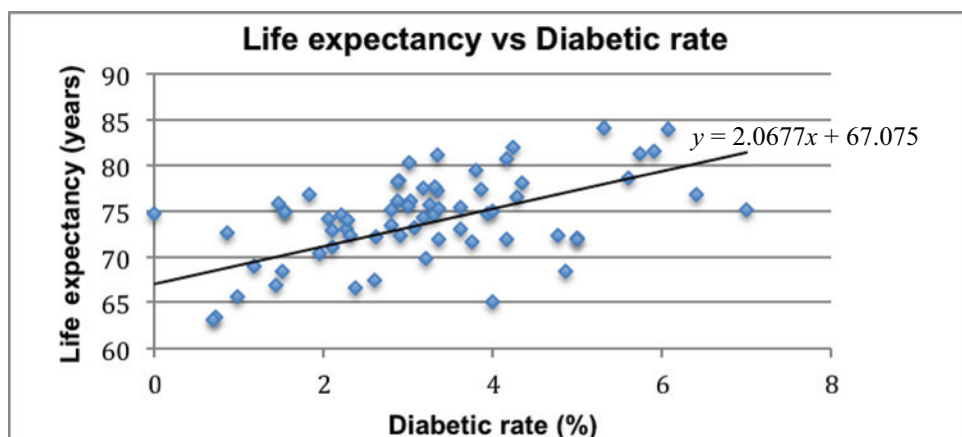


Figure 3

- (a) In about one page, discuss the relationships shown in Figures 1, 2 and 3.
- (b) (i) Predict the percentage of the adult population expected to be diabetic for a country that has GDP per capita of \$5000, and for which 71% of the adult population is obese. Justify your answer and discuss the precision of your prediction.
- (ii) In Nauru, 22% of the adult population is diabetic.

In light of the information about Nauru in Figure 4 below and your answer to (b)(i), comment on the diabetic rate for adults in Nauru.

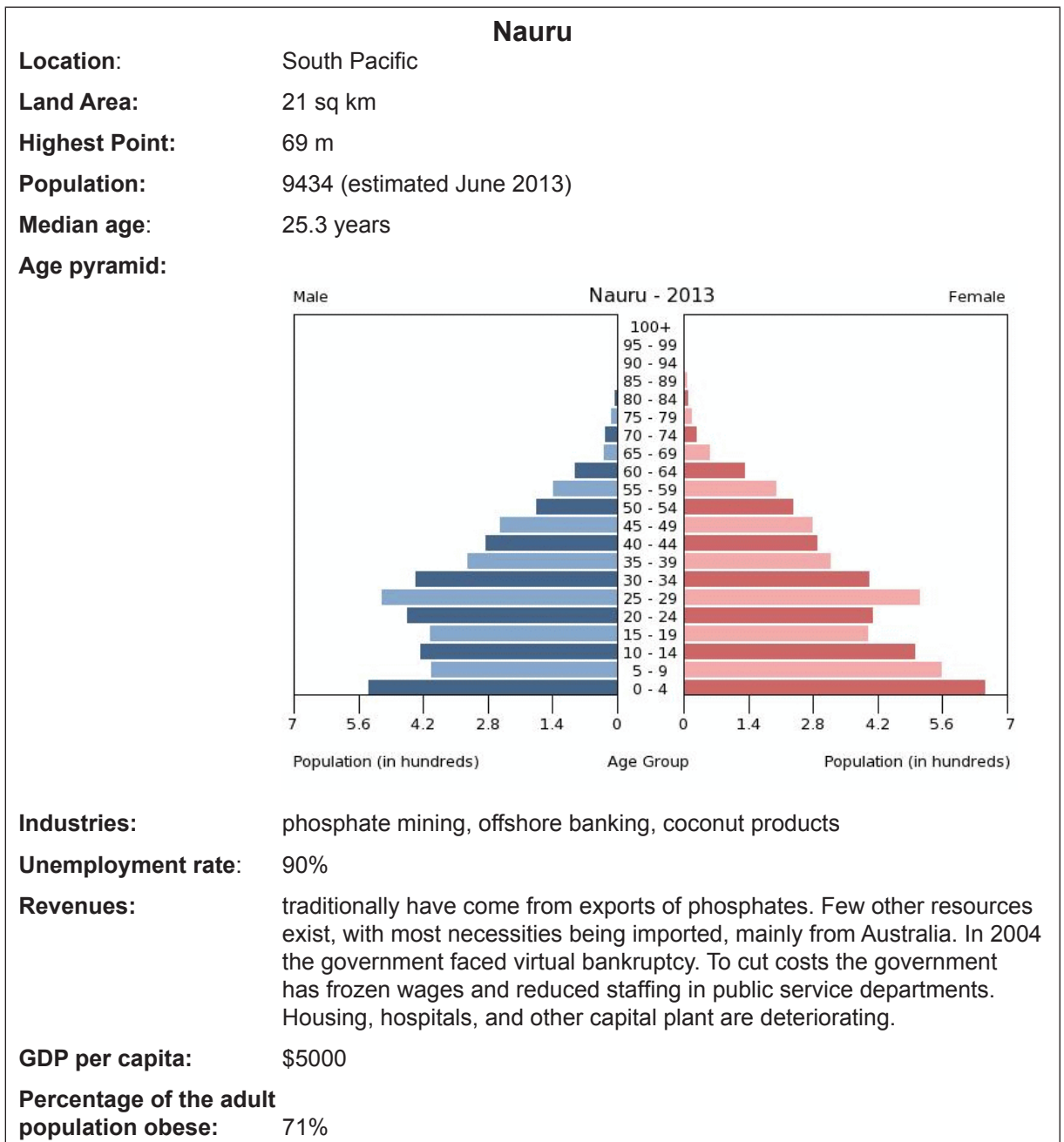


Figure 4

- (c) In a report about the overall obesity rate in New Zealand, it was claimed that the trend was toward more people being obese.

Table 1 below was included in the report.

Obesity rates in New Zealand: Changes over time

Year	2006/07	2012/13
Obesity rate (%) (95% confidence interval)	26.5 (25.5 – 27.5)	28.6 (27.4 – 29.8)

Table 1

Write a short paragraph to explain what the information in Table 1 says about the change in the obesity rate in New Zealand from 2006/07 to 2012/13.

QUESTION TWO (8 marks)

- (a) A pilot study, aimed at finding ways to combat the increasing number of overweight children in New Zealand, used children in several schools in similar socio-economic areas and having similar racial diversity for the study sample.

At the start of the study, the children were weighed and had their height and their waist circumference measured. The Body Mass Index for each child was calculated, and children were classified as being of normal weight or overweight.

Eighty-five children were identified as being overweight at the start of the study. These 85 children were randomly assigned to two groups: 42 in Group A and 43 in Group B.

A facilitator was employed to provide non-curricular activities at morning break, lunchtime, and after school for the children in Group B. The activities included outdoor games and leisure activities, such as skate boarding and kite flying.

Nothing was provided for the children in Group A.

These efforts were maintained for the next two years with the same children. After two years, all 85 children were measured again. Five of the children in Group A, and 11 of the children in Group B, were found to be within the normal weight range.

A randomisation test was carried out on the data and the resulting test output is shown in Figure 5. The tail proportion produced by the test is 0.084.

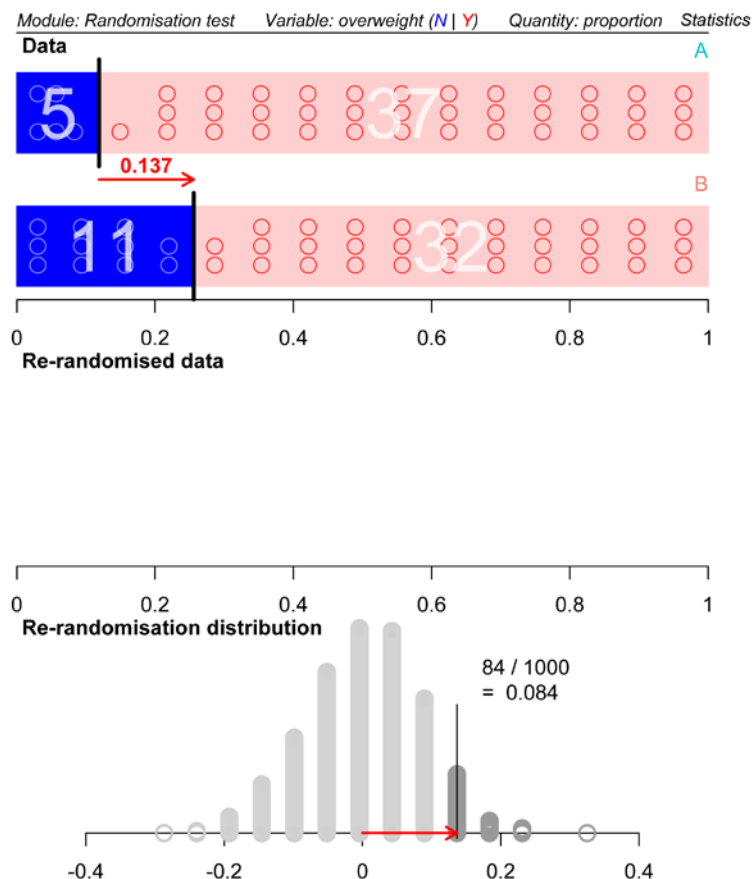


Figure 5

- (i) Explain why random assignment was used to form the two groups.
- (ii) What can be concluded from this output?
Justify your answer.

- (b) In another study, a random sample of secondary school students was surveyed about their diet. One question asked, “How many glasses of sugar-containing drinks such as juice, flavoured milk, or fizzy drink have you consumed in the past two days?”

The students were then provided with information about healthy diets, and an advertising campaign was launched through the media advocating that too many sugary drinks could lead to health problems such as diabetes and heart disease. Schools throughout New Zealand were asked to deliver to their students the same message about consuming less sugar. Six months later another random sample of secondary school students was surveyed.

Figure 6 below shows dot plots and box-and-whisker plots of the number of sugar-containing drinks consumed by the sample of students in the first survey, and then by the sample in the second survey six months later.

Table 2 gives summary statistics for these data.

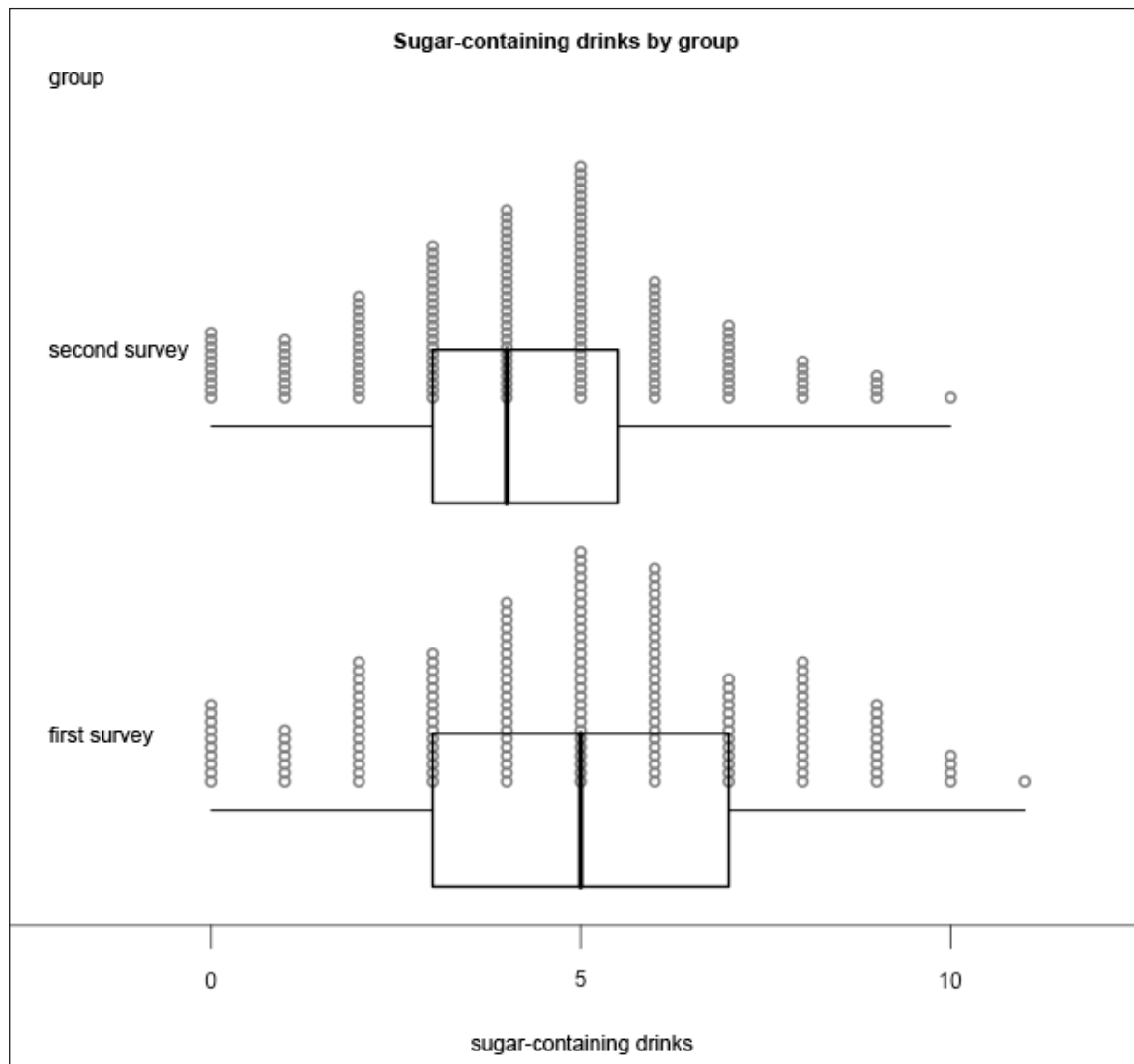


Figure 6

Summary of number of sugar-containing drinks

	Minimum	Lower quartile	Median	Mean	Upper quartile	Maximum	Standard deviation	Sample size
Second survey	0	3	4	4.3	5.5	10	2.1	155
First survey	0	3	5	4.9	7	11	2.6	167

Table 2

- (i) Describe what the two surveys found about the number of sugar-containing drinks consumed by these samples of secondary school students.

A bootstrap distribution was formed for the difference between means, and is shown in the lower part of Figure 7.

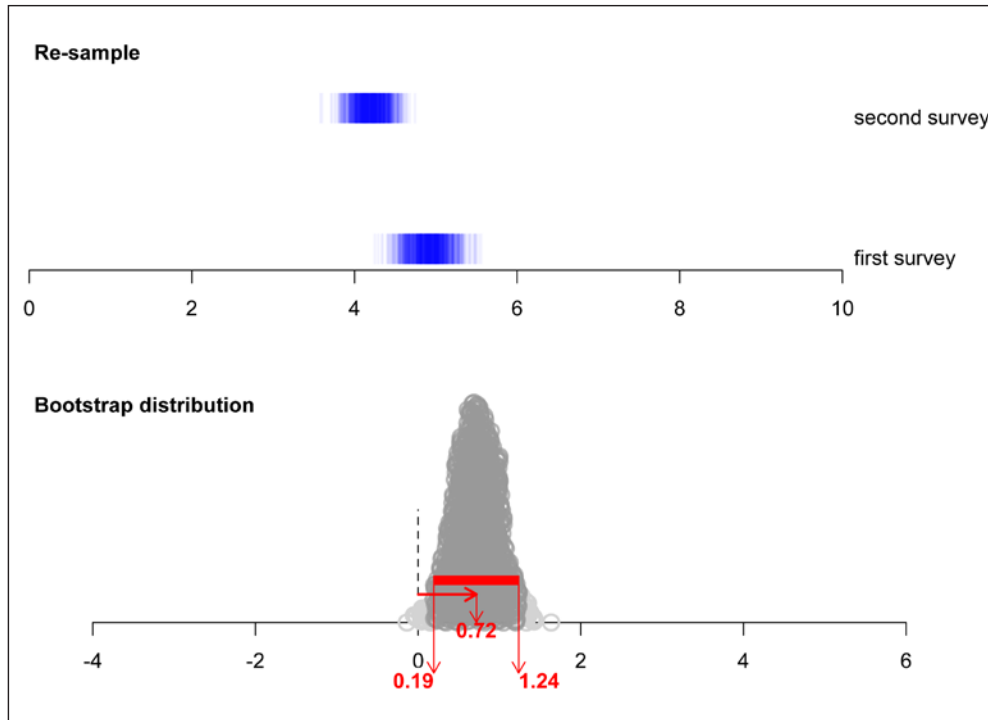


Figure 7

- (ii) Explain how the bootstrap distribution shown above was formed.
- (iii) What can be concluded from this output?

QUESTION THREE (8 marks)

Figure 8 shows obesity rates for adult men and for adult women for each of the years 2004 – 2013. The actual data for each year are also shown below the graph.

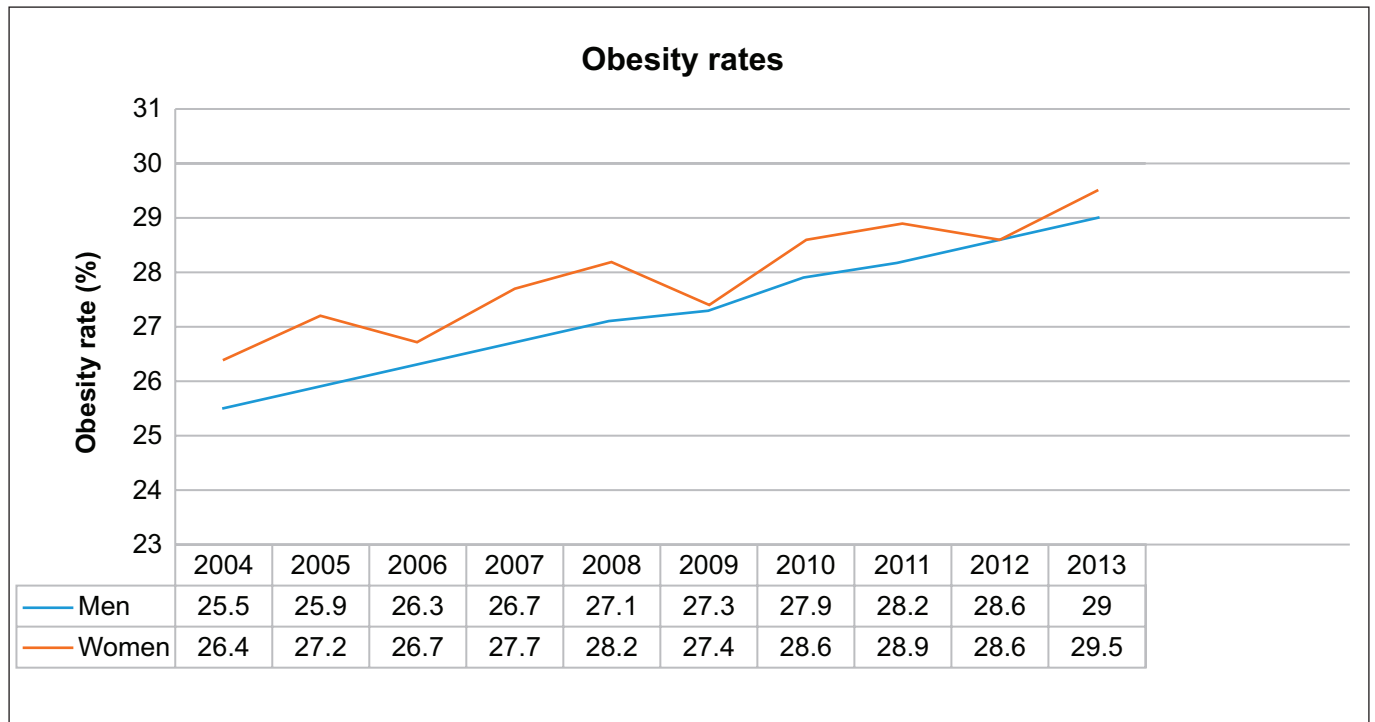


Figure 8

Figure 9 below shows obesity rates for adults in three age groups for each of the years 2004 – 2013. The actual data for each group are also shown below the graph.

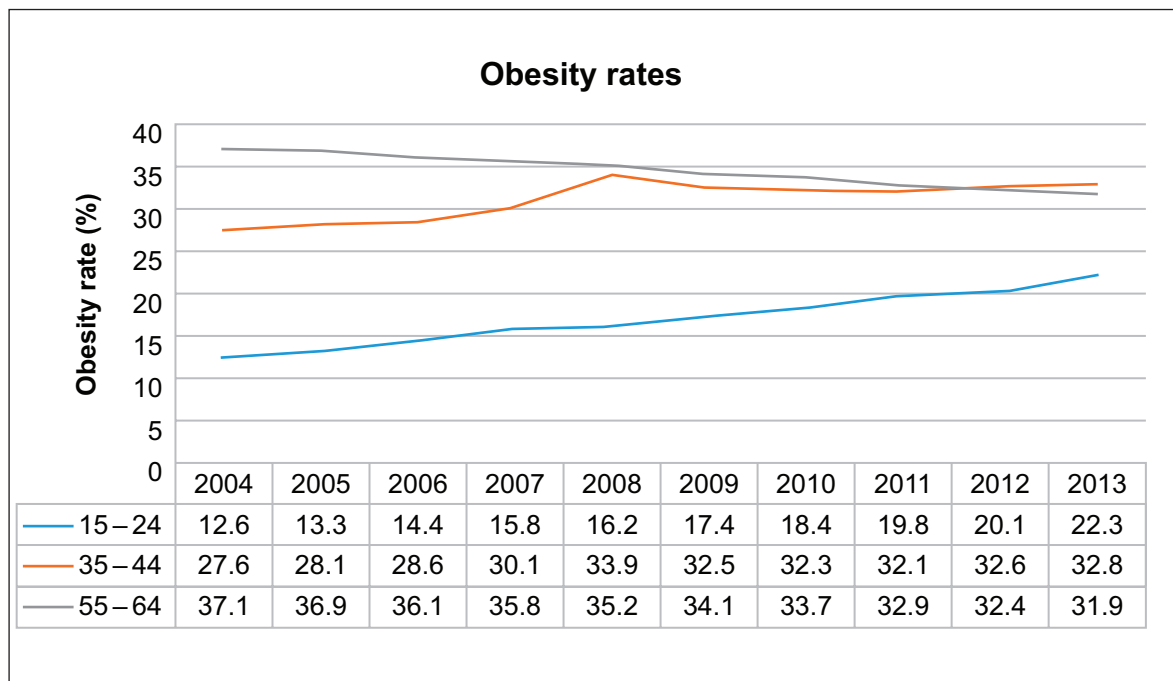


Figure 9

- (a) Using these graphs, write a paragraph describing and comparing the obesity rate over these ten years.
- (b) By using extrapolation, or otherwise, find a forecast for the obesity rate of men and the obesity rate of women in 2015.
Comment on the validity of your forecasts.
- (c) Suggest a possible reason for each of the following:
- (i) The obesity rates for women fluctuate more than the obesity rates for men over these ten years.
 - (ii) In a comparison of obesity trends within the 45–54 age group, not shown in Figure 9, two independent surveys gave conflicting results when the results in 2012 were compared with the results in 2013. One concluded an increase of 0.4 percentage points, while the other concluded a decrease of 0.2 percentage points.
- (d) How do the overall changes in the obesity rate between 2004 and 2013 compare for each age group in Figure 9?
Justify your answer.

QUESTION FOUR (8 marks)

The following statistics were obtained from a study of obesity in the New Zealand Health Survey 2012 covering the population aged 15 years and over:

- 38.6% of those in the 65–74 age group were classified as obese.
- 31.3% of the population aged 15 years and over were classified as obese.
- An estimated 1,115,000 of the population aged 15 years and over were classified as obese.
- 14.0% of the population aged 15 years and over were in the 65–74 age group.

Using this information, answer the following in relation to the population aged 15 years and over.

- (a) Calculate the probability that in a group of 1000 randomly chosen people in the 65–74 age group, no more than 360 are obese.
Justify any probability model(s) that you use.
- (b) Find the probability that a randomly chosen obese person is in the 65–74 age group.
- (c) How many times is it more likely that a person in the 65–74 age group is obese, compared to a person not in that age group?

**This page has been deliberately left blank.
The examination continues on the following page.**

QUESTION FIVE (8 marks)

Read the following extract about the trends in obesity and underweight in older children and adolescents in the United States, Brazil, China, and Russia.

*For copyright reasons,
this resource cannot be
reproduced here.*

*For copyright reasons,
this resource cannot be
reproduced here.*

*For copyright reasons,
this resource cannot be
reproduced here.*

- (a) For young persons aged 6–18 years, provide SIX pieces of evidence (three for overweight and three for underweight) that support a comparison between two countries of the trends in:
- (i) overweight
 - (ii) underweight.
- (b) Critique both Figure 1 and Table 1 in this report by suggesting an improvement to each in order to show the changes in overweight and underweight.
- (c) How would your suggestions in (b) support the argument of “changes in overweight and underweight” in each case?

93201Q