# Team Project: Great Barrier Reef Tourism Operators

300700 Statistical Decision Making, Autumn 2019

Due: Friday of Week 13 (31 May)

This Team Project analyses data on the opinions of tourism operators on the Great Barrier Reef (GBR) collected in 2013 and 2017 that were made publicly available by CSIRO.[1] The raw data have been preprocessed; the data for this project are provided in the files `TourismOperators2013.csv` and `TourismOperators2017.csv` together with this task sheet.

Each of the above files contains the following variables for the respondents who completed the survey in 2013 or 2017:

**Years** – number of years the respondent has worked in tourism on the GBR

**Optimistic** – level of agreement with the statement "I am optimistic about the future of the GBR." on a scale from 1 (strongly disagree) to 10 (strongly agree)

**QualityOfLife** – level of agreement with the statement "The GBR contributes to my quality of life." on a scale from 1 (strongly disagree) to 10 (strongly agree)

**WantToProtect** – level of agreement with the statement "I would like to do more to help protect the GBR." on a scale from 1 (strongly disagree) to 10 (strongly agree)

**ClimateChangeView** – which of the following statements the respondent most agrees to:

1 "Climate change is an immediate threat requiring action."
2 "Climate change is a serious threat, but the impacts are too distant for immediate concern."
3 "I need more evidence to be convinced of the problem."
4 "I believe that climate change is not a threat at all."
5 "I do not have a view on climate change."

## 1 Number of years in GBR tourism

We want to investigate how much experience tourism operators on the GBR had in 2013.

(a) [1 mark] Comment on the distribution of the variable `Years` in the 2013 data set. Use appropriate plots and / or numerical measures to justify your analysis.

(b) [1 mark] Use bootstrapping to compute a 99% confidence interval for the mean number of years of experience a tourism operator on the GBR had in 2013.

(c) [1 mark] Use the Central Limit Theorem to compute a 99% confidence interval for the mean number of years of experience a tourism operator on the GBR had in 2013 and compare your result to the interval found in part (b).

[1] https://doi.org/10.25919/5c74c7a7965dc

## 2 Proportion of GBR optimists

We want to investigate the proportions of tourism operators who were generally optimistic about the future of the GBR in 2013 and 2017, that is, whose level of agreement with the statement "I am optimistic about the future of the GBR" was at least 6 out of 10.

### (a) Proportion of GBR optimists in 2013

We want to test whether there is evidence that the proportion of tourism operators who were generally optimistic about the future of the GBR in 2013 was less than 70%.

(i) [1 mark] Formulate an appropriate hypothesis test and use the function `prop.test` to compute the $p$-value of the data in the test.

(ii) [1 mark] Use randomisation to compute the $p$-value of the data in the test from part (i).

(iii) [0.5 marks] Compare the results from parts (i) and (ii) and state the conclusion of the test at a significance level of 5%.

### (b) Proportions of GBR optimists in 2013 vs. 2017

We want to test whether there is evidence that the proportions of tourism operators who were generally optimistic about the future of the GBR in 2013 and 2017 were different.

(i) [1 mark] Formulate an appropriate hypothesis test and use the function `prop.test` to compute the $p$-value of the data in the test.

(ii) [1 mark] Use randomisation to compute the $p$-value of the data in the test from part (i).

(iii) [0.5 marks] Compare the results from parts (i) and (ii) and state the conclusion of the test at a significance level of 5%.

## 3 Contribution to quality of life vs. willingness to protect the GBR

We want to test whether there is evidence that the 2013 levels of tourism operators' agreement with the statements "The GBR contributes to my quality of life." and "I would like to do more to help protect the GBR." are positively correlated.

(a) [0.5 marks] Formulate an appropriate hypothesis test.

(b) [1 mark] Compute the $p$-value of the data in the test from part (a).

(c) [0.5 marks] State the conclusion of the test from part (a) at a significance level of 10%.

## 4 Changes in views on climate

We want to investigate whether the views of tourism operators on climate change have changed between 2013 and 2017.

(a) [1 mark] Use a $\chi^2$-test for goodness of fit to assess, by computing the $p$-value of an appropriate hypothesis test, whether there is evidence that the proportions of the 5 views on climate change in 2017 are different from the proportions of the 5 views for the respondents in the 2013 survey.

(b) [1 mark] Use a $\chi^2$-test for independence to assess, by computing the $p$-value of an appropriate hypothesis test, whether there is evidence that the proportions of the 5 views on climate change are associated to the categorical variable with the categories 2013 and 2017.

(c) [1 mark] Compare the $p$-values obtained in parts (a) and (b). Discuss the difference between the tests in parts (a) and (b), and explain which is more appropriate and why.

## Submission

One report is to be submitted by each team by the due date, containing the description of a solution to the tasks above, including any R code, and the results obtained.

**The report is to be written in R Markdown, using the template available on the unit's vUWS site.**

After editing the R Markdown file, *knit* it to Word (not HTML!) in R Studio (see `http://rmarkdown.rstudio.com` for full details on R Studio and R Markdown) and then convert the resulting `.docx` file to PDF using MS Word. Alternatively, you can *knit* to HTML and convert the resulting `.html` file to PDF using a web browser (with a suitable plugin or a virtual printer). If you have LaTeX installed (`https://www.latex-project.org`), you can also *knit* your R Markdown file directly to PDF.

After checking that the PDF file is formatted correctly, submit it using the link *Team Project* in the *Team Project* tab on the unit's vUWS site. **Do not submit a file in any format other than PDF.** If you submit a file in another format, it may not be possible to mark your report, or you may lose marks due to bad formatting of code, plots or text.

The first page of your report must contain the declaration shown in Figure 1; you make this declaration by submitting your report. **Do not remove this declaration! A marker has the right not to mark your report if the above declaration is not included in the report.**

## Marking Criteria and Standards

The Team Project will contribute a maximum of 15 marks towards your final mark.

The value of each of the tasks is indicated. Marks are awarded according to the following criteria:

- choice of correct method for sampling, bootstrapping, randomisation and / or analysis;
- correctness and clarity of R code; and
- correctness and clarity of analysis or interpretation.

In addition, 2 marks are awarded for the overall quality and presentation of the report.

Teams should discuss all aspects of the project: Working in a team on a statistical project is an assessable learning outcome of the unit, and the report will be treated as a team submission. The contributions by each team member must be indicated on the cover sheet.

Remember that the marker will only see what you have written, therefore, comment your R code and clearly explain all decisions made, as well as the analysis and your interpretation of the results. (Don't expect the marker to spend ages trying to figure out what you might have meant to say!)

The formatting of your report may affect its readability and the clarity of your explanations, and hence contributes to your mark.

By including this statement, all authors of this work declare that:

- We hold a copy of this assignment if the original is lost or damaged.
- We hereby certify that no part of this assignment has been copied from any other student's work or from any other source except where due acknowledgement is made in the assignment.
- No part of the assignment has been written for us by any other person except where collaboration has been authorised by the unit coordinator.
- We are aware that this work may be reproduced and submitted to plagiarism detection software programs for the purpose of detecting possible plagiarism; this software may retain a copy on its database for future plagiarism checking.
- We hereby certify that no part of this assignment or product has been submitted by any of us in another (previous or current) assessment, except where appropriately referenced, and with prior permission from the unit coordinator for this unit.
- We hereby certify that we have read and understand what the University considers to be academic misconduct, and that we are aware of the penalties that may be imposed for academic misconduct.

| Name | Student Number | Contribution (%) |
|---|---|---|
| | | |

Figure 1: Statement to be included on the first page of each submission.