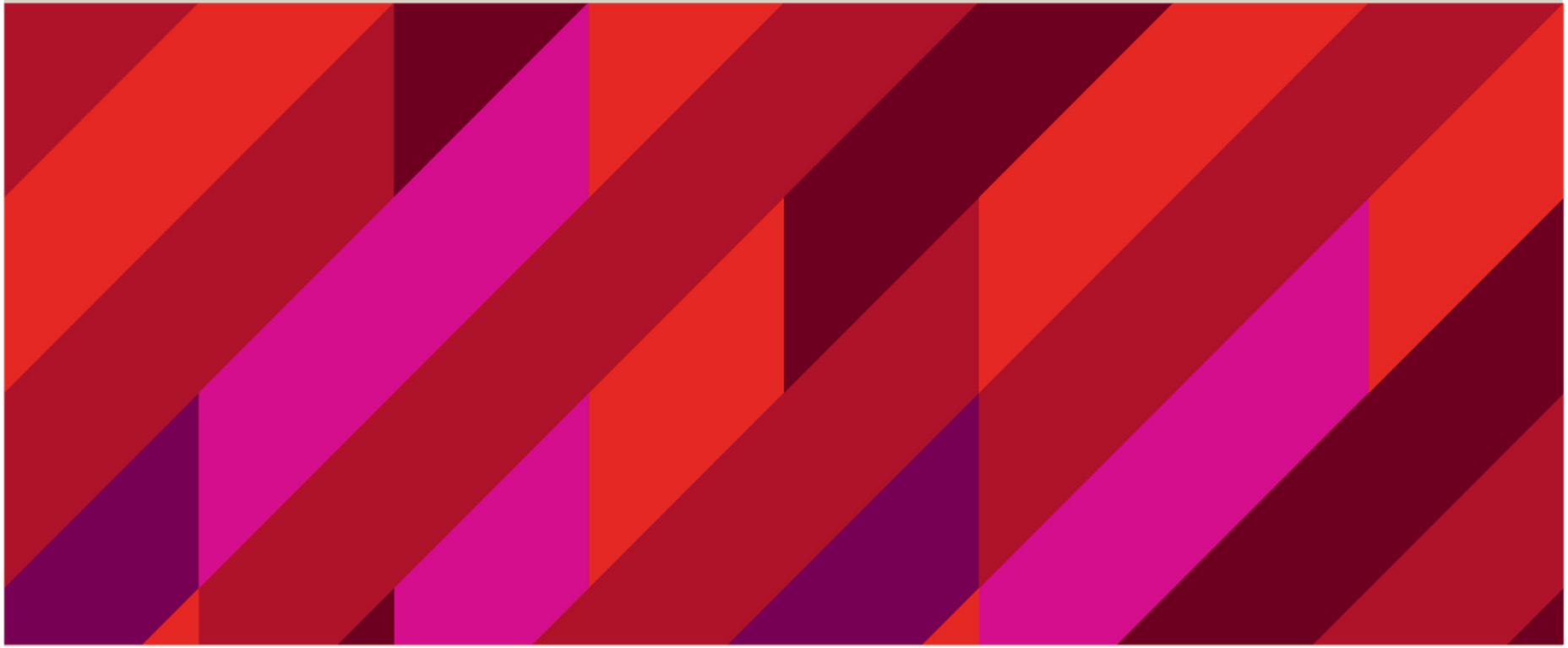
MACQUARIE University

E-Assessment for a large first year business statistics unit Opportunities created by COVID-19

A/PROF AYSE AYSIN BILGIN
MACQUARIE UNIVERSITY,
DEPARTMENT OF MATHEMATICS AND STATISTICS, AUSTRALIA
28 JUNE 2021

E-A×M+S 2021
21st June - 2nd July



Challenges of Assessment with COVID-19

- More than 1000 students in each semester
- Students scattered around the world due to COVID-19 travel restrictions
- Traditional exams are close to impossible due to logistics (i.e. different locations, different COVID-19 restrictions)

Aims for the solution

MACQUARIE University

- Provide reach, timely feedback to the students
- Eliminate logistic problems
- Discourage academic dishonesty – safeguard academic honesty
- Keep the student voice in the assessment
- Achieve consistency of marking

Online non-invigilated assessment(s)

- require entering a numerical value after calculations
- require selecting an option from a set of options
- **require downloading a data set, analysing data then either entering a numerical value after calculations or selecting an option from a set of options**

  (All of the above are created using R-exam package)
- require text answers (manually marked)

A question that required manual online marking

MACQUARIE University

An online retail store seeks the opinion of its customers on which new fabrics it should invest in. The store posts an open and unrestricted survey link to their Instagram and collects 500 responds from the followers of the company's Instagram posts.

Briefly explain your thoughts on the following questions.

a. What is the target population?

b. Will the company obtain a random sample with their design described above?

c. How should the company select a simple random sample?

A question that required manual online marking

MACQUARIE University

Marking:

a. The target population is the company's customers. (1 mark)

b. Possibly not. There is no indication that all of company's customers are followers of the Instagram posts. If customers do not have Instagram accounts or do not follow the company's Instagram posts, they have no chance to be included in the sample which means the sample can not be a random sample. (2 marks)

c. Company could randomly select customers from their database of purchases using a computer software (i.e. Excel or any other software). The send an email (since the customers are making purchases we can safely assume that they have provided email addresses) to the randomly selected customers. (2 marks)

Manual online marking: Markers' view

MACQUARIE University

Questions that need grading

Also show questions that have been graded automatically

Q #	T	Question name	To grade	Already graded	Total
6		Interpretation of Table 2	0	60 update grades	60 grade all
6		Chi Square Assumptions	0	65 update grades	65 grade all
6		Interpretation of Figure 2	0	71 update grades	72 grade all
6		Interpretation of Figure 1	0	54 update grades	54 grade all
6		Interpretation of Figure 3	0	64 update grades	64 grade all
6		Identify which graphs 1	0	74 update grades	75 grade all
6		Interpretation of Figure 4	0	64 update grades	64 grade all
6		Which graph 2	0	58 update grades	58 grade all

A question that required downloading and analysing data

MACQUARIE University

A health researcher used a random sample of 27 countries to investigate life expectancy at birth patterns of two regions. The output below was constructed from this study for comparing average life expectancy at birth of countries in two regions. The average life expectancy at birth for both group of countries are stored in LifeExpectancy.xlsx. Download and open this file into Excel.

Use Excel to carry out a suitable test to address the following research question:

Is there a difference between the average life expectancy at birth for countries in two regions?

For the remaining questions you may assume that any relevant assumptions have been met.

4. (2 marks) The absolute value of the test statistic is equal to (type your answer with 3 dp)

5. (1 mark) The degrees of freedom is equal to (type your answer as an integer)

6. (1 mark) The p-value is larger than 0.05

7. (2 marks) The test shows that the average life expectancy at birth was (choose one of the following)

   A: could be significantly different (greater for countries in region 2 than for countries in region 1).

   B: could be significantly different (greater for countries in region 1 than for countries in region 2).

   C: not significantly different for counties in two regions.

Creating the Question in R

MACQUARIE University

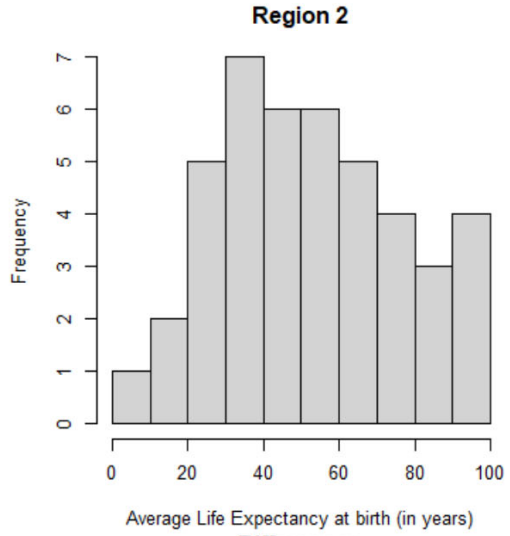
```r
n<-sample(seq(25,45),1)    # 2021 S1 simulated data
gp1<-round(rnorm(n,60,30),2)
gp2<-round(rnorm(n,70,30),2)

gpdiff<-gp1-gp2

dat <- data.frame(Region1=gp2,Region2=gp1)

#Region1<-as.character(region[[1]])
#Region2<-as.character(region[[2]])

library(WriteXLS)
WriteXLS(dat, "LifeExpectancy.xlsx")

## questions/answer
questions <- solutions <- explanations <- points <- rep(list(""), 7)
type <- rep(list("schoice"), 7)

tt <- t.test(gp1, gp2, var.equal = TRUE, alternative = "two.sided")

questions[[1]] <- c("A two-sample t-test","A paired t-test")
solutions[[1]] <- c(n[1] > 1, n[1]==1)

```

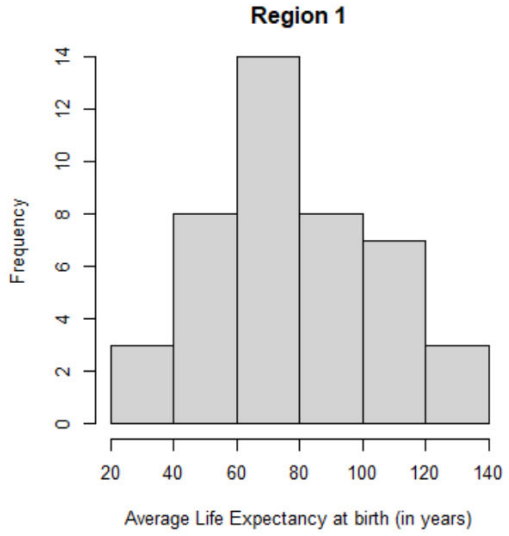
Creating the Question in R

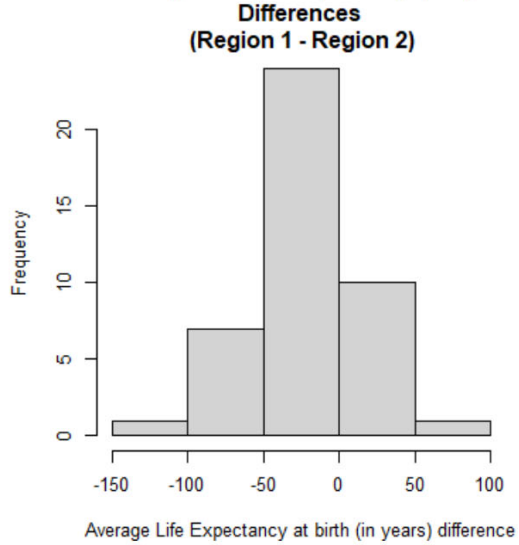
MACQUARIE University

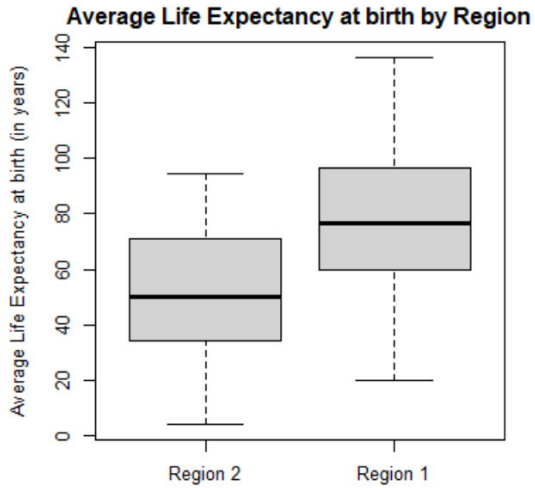
```
78  A health researcher used a random sample of `r n` countries to investigate life
    expectancy at birth patterns of two regions.  The output below was constructed
    from this study for comparing average life expectancy at birth of countries in
    two regions. The average life expectancy at birth for both group of countries
    are stored in [LifeExpectancy.xlsx](LifeExpectancy.xlsx). Download and open this
    file into Excel.
79
80  Use Excel to carry out a suitable test to address the following research
    question:
81
82  *Is there a difference between the average life expectancy at birth for
    countries in two regions? *
83
84
85  ```{r histo, echo = FALSE, results = "hide", fig.height = 8, fig.width = 8,
    fig.path = "", fig.cap = ""}
86  par(mar = c(4,4, 2.5, 2), mfrow=c(2,2))
87  hist(gp1, main="Region 2", xlab="Average Life Expectancy at birth (in years)")
88  hist(gp2, main="Region 1", xlab="Average Life Expectancy at birth (in years)")
89  hist(gpdiff, main="Differences\n (Region 1 - Region 2)", xlab="Average Life
    Expectancy at birth (in years) difference")
90  boxplot(gp1,gp2, names=c("Region 2","Region 1"), main="Average Life Expectancy
    at birth by Region", ylab="Average Life Expectancy at birth (in years)")
```

Creating the Question in R









Creating the Question in R

MACQUARIE University

```
Meta-information
================
extype: cloze
exsolution: `r paste(solutions, collapse = "|")`
exclozetype: `r paste(type, collapse = "|")`
exname: 2-sample t-test
exsection: Final Exam 2021 S1/ttest_two sample or paired/twosample_4
extol: `r tol`
expoints: `r paste(points, collapse = "|")`
```

Creating many versions of a question in R

MACQUARIE University

```
1  library(exams)
2
3  #Q4 Two sample or paired t-test (9 Marks)
4  myexam<-list("ttest1x_4.rmd", "paired1x_4.rmd")
5  exams2moodle(myexam, n = 150, num = list(solution = FALSE))
```

Questions in LMS - Moodle

MACQUARIE University

- Final Exam 2021 S1 (0)
  - ChiSquare (0)
    - 3 (128)
  - contingency_table (50)
  - One Sample t-test (0)
    - 3 (150)
  - Open Ended Questions (0)
    - Describe Patterns in Table or Figure (29)
    - Random-representative-variable types interpretations (25)
  - probabilities (0)
    - 3 (150)
  - regression (0)
    - 3a (150)
  - ttest_two sample or paired (0)
    - paired_3 (120)
    - twosample_3 (70)
    - twosample_4 (50)
  - Upload File (1)

Outcomes

MACQUARIE University

- Students found it easy to take online assessments
- Feedback provided them opportunities to learn from their mistakes
- No (exam) paper was lost
- No academic dishonesty was identified
- Marking completed in much shorter time while consistency of marking was ensured

Impact

Assessment of students learning was as good as before COVID-19 – grade distributions and failure rates were very similar in 2019 S2 and 2020 S2

Are we there yet?

We need to

- improve the quality of the questions (i.e. clarity, language)
- increase the variety of the questions
- increase the number of alternatives for randomisation
- improve assessments so that students continue learning, assessment should not be the end but it should be the continuation of learning