A28423

Calculators may be used in this examination provided they are not capable of being used to store alphabetical information other than hexadecimal numbers

UNIVERSITY OF BIRMINGHAM

School of Computer Science

First Year – MSc in Computer Science
First Year – MSc in Computer Security
First Year – MSc in Human-Computer Interaction

06 23856

Evaluation Methods and Statistics

Summer Examinations 2013

Time Allowed: 1:30 hours

[Part A : Answer ALL Questions
Part B: Answer Two Questions out of 3]

Part A

[Answer ALL Questions]

1. (a) In statistical inference what conclusion can be drawn from a p-value that is smaller than the predetermined significance level of 0.05? [3%]

(b) Jenny tests her data with a Pearson's correlation and finds r = 0.53 and p = 0.008. She has 131 participants in her study. Report the result of the test using the correct reporting conventions. First give a statement in English about the significance, or otherwise, of the correlation. [3%]

(c) A Shapiro-Wilk test is found to give a p value of 0.01. What does this mean for the data tested? [2%]

(d) Richard is looking to perform 8 t-tests on his data. What should he take into consideration when conducting this number of t-tests? Name 2 procedures that can be used to correct the p value for this? [3%]

(e) Write down the following R commands with their results.

```
X1 ← c(9, 1, 11)
X2 ← c(8, 7, 3)

M1 ← median(X1)
M2 ← median(X2)
M1
M2

R ← c ( mean(X1), mean(X2))
R

mean(R)
```

[3%]

(f) Write down R commands that would solve the following equation for the variance V of X where there are N observations:

$$V = \frac{\sum\left(X - \bar{X}\right)^2}{N-1}$$

Start with:

X ← c(4,2,9,1)
N ← length(X)

[3%]

(g) Researchers at TuneBox are looking to see how 3 different display designs for their music player interface impact speed of selection for albums. The designs include a tab-based, an icon-based and a text list layout. Write down the levels of the independent variable and the dependent variable. [3%]

2. Calculate the t-test statistic for the within subjects data below. Please show your working and use the formula supplied.

$$t = \frac{\overline{D}}{\frac{\sqrt{\frac{\sum D^2 - \frac{(\sum D)^2}{N}}{N-1}}}{\sqrt{N}}}$$

Participant	X1	X2
1	2	0
2	4	1
3	4	3
4	7	9
5	5	1
6	11	8
7	2	0
8	5	5
9	6	5
10	6	7

[20%]

Part B

[Answer Two Questions out of 3]

3. (a) Describe what happens when people try and name the ink colour of colour words printed on a computer display. How might these effects be used to test theories concerning the top-down and bottom-up processing of information in computer users? In your answer describe the hypothesis, null hypothesis, sampling policy, etc. Also describe the expected shape of the Reaction Time distributions as well as the expected shape of the distribution of means. Describe what statistical test might be used and how it would be reported. (Specific values are not required.) [20%]

   (b) Sparrow, Liu & Wegner (2011) have provided evidence that a person's mind activates words associated with the internet when presented with hard questions. Critically analyse the similarities and differences between Sparrow et al.'s (2011) paradigm and the standard Stroop paradigm. [10%]

4. (a) It is known that the movement time of a mouse pointer to a button is dependent on the distance to the button and on the width of the button. Describe the law that represents this relationship and why it is important to Human-Computer Interaction? How would you test this law? [20%]

   (b) What are the limitations of using this law to predict the implications of a new Air Traffic Control system? [10%]

5. The Research and Development team at Davis TV are looking to test how people improve speed of performance when using a new speech interface system compared to the current speech interface system used on their Smart TVs.

   You are acting as a consultant evaluator.

   (a) Identify the variables in the experiment and describe the hypotheses being investigated in the experiment. [10%]

   (b) Identify an appropriate experiment design and justify the type of design chosen. You should also describe any considerations that need to be made in running the experiment. [10%]

   (c) Identify the statistical test you would use. In addition, identify what assumptions the data you gather must meet before you can conduct this test and, where appropriate, what statistical tests are used to test these assumptions? [10%]