A28423

Calculators may be used in this examination but must not be used to store text. Calculators with the ability to store text should have their memories deleted prior to the start of the examination

UNIVERSITY OF BIRMINGHAM

School of Computer Science

Fourth Year Undergraduate/Postgraduate

23856

Evaluation Methods & Statistics

Main Summer Examinations 2019

Time allowed: 1:30

[Answer all questions]

Answer three out of four questions. Each question is worth 20 marks. The paper will be marked out of 60 which will be scaled to a mark out of 100

1. A between-subjects study has participants completing a data entry task using a conventional spreadsheet and a new data organisation tool. 20 participants complete a standard data entry task (name, address, telephone etc.) and their total completion times (in ms) are given in table 1.

Conventional	New tool
750	525
625	435
900	725
1250	1000
450	500
650	645
800	650
925	800
1100	725
875	700

(a) Using the appropriate formula from the formula sheet provided, calculate the Independent t-statistic for these data. Report your result in standard format (assuming you are applying a one-tailed test). [12 marks]

(b) Using the appropriate formula from the formula sheet provided, calculate the Effect Size of this result. [4 marks]

(c) What conclusion can you draw from your analysis, in terms of the null and alternative hypotheses? [4 marks]

2 (a) Construct a Hierarchical Task Analysis (HTA) diagram for the activity of sending a message using Short Message Service (SMS), i.e., a 'text message' from a mobile telephone. Indicate how a recipient is identified, how a message is composed and how the message is sent. Provide Plans for the high-level subgoals (i.e., at level 1, 2, 3 etc.), ideally, provide more than one Plan for each of these high-level subgoals. [10 marks]

(b) Consider two of the Plans that you have proposed for <u>one</u> of the high-level subgoals (in 2a). How would you design an experiment to compare these? [5 marks]

(c) From your HTA diagram, how could you identify opportunities to improve the way in which the task is performed? How could these redesigns be supported by redesigning the technology? [5 marks]

3 (a) Define the terms ‘Dependent Variable’, ‘Independent Variable’ and ‘Confounding Variable’. [6 marks]

(b) Explain, with a suitable diagram, the difference between Type I and Type II error. [6 marks]

(c) You use R to run a two-way Analysis of Variance on data from an experiment. The output is shown below:

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Time	1	2042344	2042344	1759.76	<2E-16***
Device	3	129876	43292	37.30	<2e-16***
Time:Device	3	80804	26935	23.21	3.47e-14***
Residuals	570	667532	1161		

Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

(i) Explain the design of this experiment. [2 marks]

(ii) Report the results for the two independent variables and the interaction effect. [3 marks]

(iii) What steps can be taken to reduce the possibility of Type I error with ANOVA? [3 marks]

4 The International Standard ISO9241 defines Usability in terms of a Context of Use and as measured by Effectiveness, Efficiency and Attitude.

(a) Explain what the term ‘Context of Use’ means, and give examples of dependent variables that can be used for Effectiveness, Efficiency and Attitude in Human-Computer Interaction. [5 marks]

(b) Explain how the notion of Context of Use applies to the evaluation of an in-car satellite navigation system. [10 marks]

(c) You have been asked to compare a SatNav with a visual display on map and route guidance, with one that only provides audio output. What differences might you anticipate in the use of these devices? How can you design an evaluation trial that would use a two-way Analysis of Variance to provide a fair test of the advantages and disadvantages of each device? [5 marks]

End of Paper

Any calculator

Do not complete the attendance slip, fill in the front of the answer book or turn over the question paper until you are told to do so

Important Reminders

- Coats/outwear should be placed in the designated area.
- Unauthorised materials (e.g. notes or Tippex) must be placed in the designated area.
- Check that you do not have any unauthorised materials with you (e.g. in your pockets, pencil case).
- Mobile phones and smart watches **must** be switched off and placed in the designated area or under your desk. They must not be left on your person or in your pockets.
- You are not permitted to use a mobile phone as a clock. If you have difficulty seeing a clock, please alert an Invigilator.
- You are not permitted to have writing on your hand, arm or other body part.
- Check that you do not have writing on your hand, arm or other body part – if you do, you must inform an Invigilator immediately
- Alert an Invigilator immediately if you find any unauthorised item upon you during the examination.

Any students found with non-permitted items upon their person during the examination, or who fail to comply with Examination rules may be subject to Student Conduct procedures.