UNIVERSITY OF BRISTOL

JANUARY 2015 Examination Period

FACULTY OF ENGINEERING

Second Year Examination for the Degrees of BSc and MEng

COMS21301J
Human-Computer Interaction

TIME ALLOWED:
2 Hours

This paper contains *four* questions, each worth 20 marks.
The best *three* answers will be used for assessment,
for a maximum total of 60 marks.

OTHER INSTRUCTIONS:
Calculators must have a Faculty seal

TURN OVER ONLY WHEN TOLD TO START WRITING

Q1 The HCI field has drawn on an increasingly diverse array of disciplines to understand user perspectives and behaviours. Disciplines that have contributing new methods include Sociology, Psychology, and Art.

(a) Selecting from the 1980s, 1990s and 2000s, match these three disciplines to the approximate decade they were introduced to the HCI field.

(3 marks)

Psychology: 1980s
Sociology: 1990s
Art/Design: 2000s

(b) For these three areas, name the most important new technique or methodology they provided HCI for studying user behaviour.

(3 marks)

Any variations on the following basic ideas will be acceptable:
Psychology: Quantitative Experiments
Sociology: Ethnography
Art: Design

(c) Describe one benefit and one drawback of each of the techniques or methodologies you mentioned in the previous part.

(6 marks)

Any suitable answer will receive a mark although the following are most likely:
Quantitative experiments benefits: rigorous, accurate, simple to use and apply results
Quantitative experiments drawbacks: limited or too specific in relationship to real world, hard to arrange with mobile or collaborative technologies
Ethnography benefits: good for real-world settings, catch unanticipated results
Ethnography drawbacks: hard to re-use results for new situations or technologies
Design benefits: Take into account 'modern' benefits beyond efficiency or mundane work improvements
Design drawbacks: Hard to measure and gauge against related work, intangible principles

(d) Focusing on emerging technology paradigms, describe in detail two challenges for studying user behaviour that are still a problem for HCI methodologies.

(8 marks)

Again, any suitable answer will gain marks, 4 per challenge. Most likely 2 challenges are:
1. Mobile/pervasive/ubiquitous/distributed technologies are still hard to study regardless of methodology e.g. ethnography good for following users in mobile settings, but results suffer from Hawthorne effects (1 (1); approaches to overcome this include mixed methods approaches (1).
2. It remains the case that experimental results are more generaliseable than qualitative studies, but that qualitative work always identifies issues not considered in lab work (1). E.g. experimental results require the category of answer to be defined before exploring it leaving no recourse if the wrong question is being asked (1). Furthermore, real-time adaptive techniques are not generally used in Psychology settings (1). Merging the real world with experimental techniques, such as distributed experimental designs may help (1).

Q4 Answer the following questions on models of input and output.

(a) Give the formula for Reaction Time *RT* suggested by the Hick-Hyman law to react to the onset of a stimulus and make the appropriate response, given *n* possible stimuli. Explain what pattern of choices is modelled by the function.

(4 marks)

RT = a + b$\log_2$(n) (2). The function models the elimination of half the possible choices in a linear amount of time (2)

(b) Given a novel keyboard layout with only alphabetic keys, and the constants *a=0* and *b=0.3*, use the Hick-Hyman law to calculate the reaction time to find any given letter.

(6 marks)

n=26 (2). RT=0+0.3($\log_2$26) (2) = 1.41s (2)

(c) Explain why your previously calculated Reaction Time would not necessarily apply to a QWERTY keyboard.

(4 marks)

Hick Hyman only applies to random choices, not informed ones (1). QWERTY is both designed (1) and frequently used (1) to skew reaction times for particular letters (1).

(d) In your opinion, why do Fitts' Law and Hick-Hyman law have similar formulae? Refer to the constant(s) as well as the function(s).

(6 marks)

A constant 'a' is used to account for reaction time (1). A constant 'b' is used to account for individual differences in task performance (1). A binary logarithm is used (1) to indicate that approximately half of the quantity (1) is perceptually discarded by the user (1) in a linear amount of time (1).

Q2 Answer the following questions on interaction design and privacy.
See below

Q3 Answer the following questions on qualitative research and interaction design.
See below

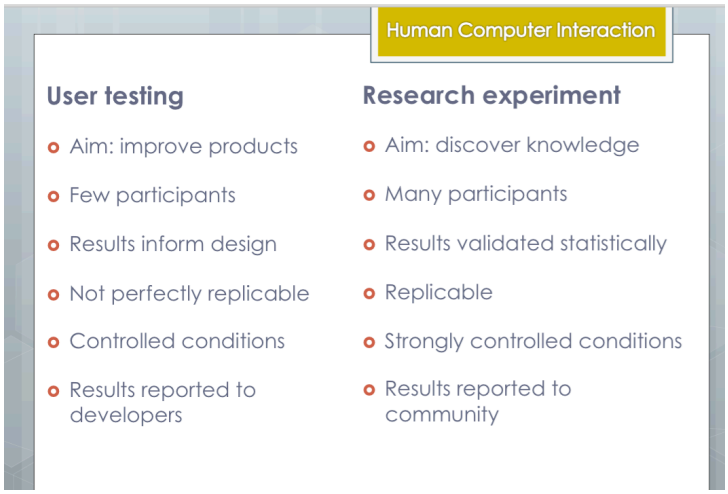
End of Paper

Answer the following questions on experimental design and statistics.

(a) Describe four of the key differences between user tests and empirical research experiments.

(4 marks)

Any of the following are fine:



(b) Statistical analysis of empirical experiments works with four distinct data types. Name the data type that describes each of the following:

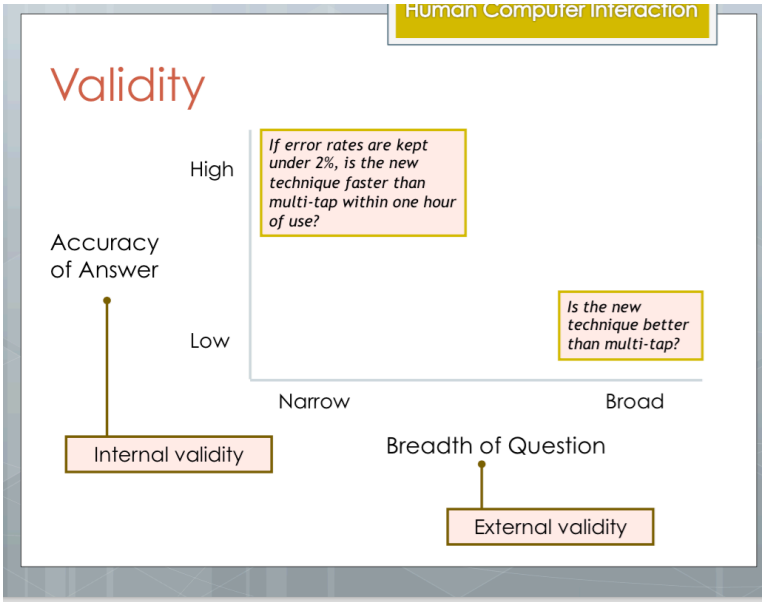
- Height
- Gender
- Responses to a five point Likert scale question
- Temperature measurements

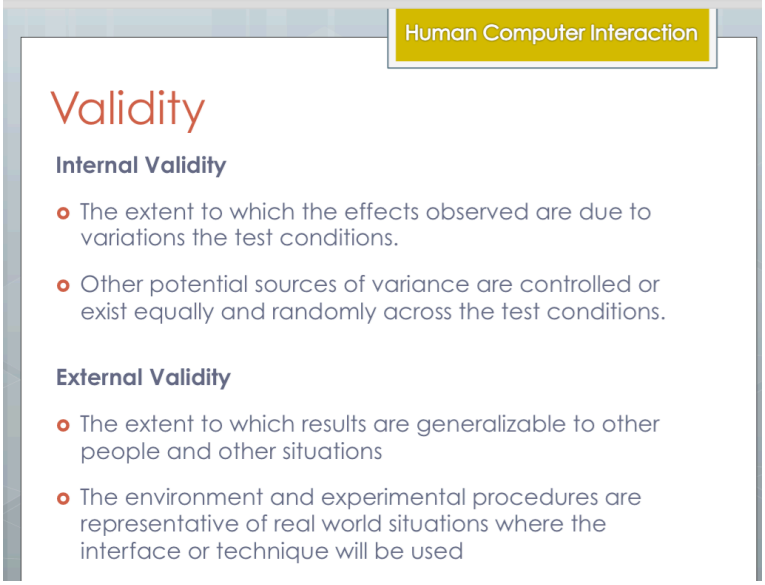
(4 marks)

Height = Ratio
Gender = Nominal
Responses to a five point Likert scale question = Ordinal
Temperature measurements = Interval

(c) Explain the difference between experiments with high internal and high external validity. What are the strengths and weakness of each type of experiment?

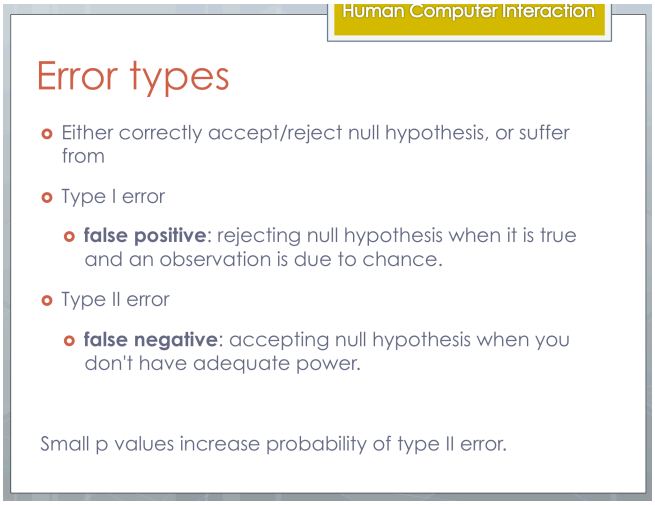
(4 marks)





(d) Null hypothesis statistical tests can suffer for two types of errors. Name and explain each of these error types.

(4 marks)



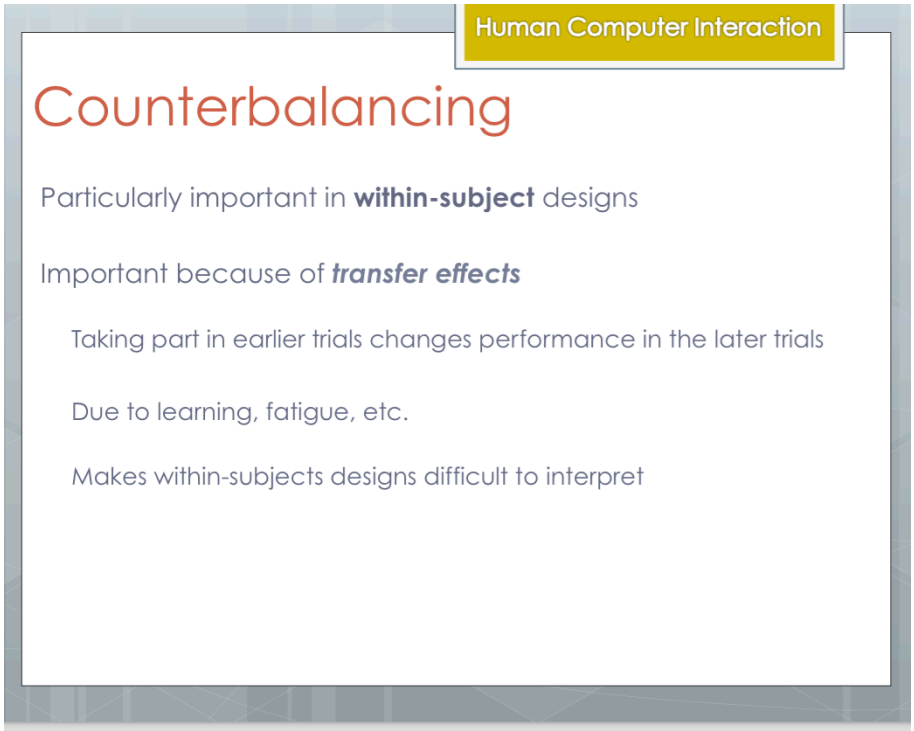
(e) What impact does the choice of the p value for a statistical test have on the probability of different error types?

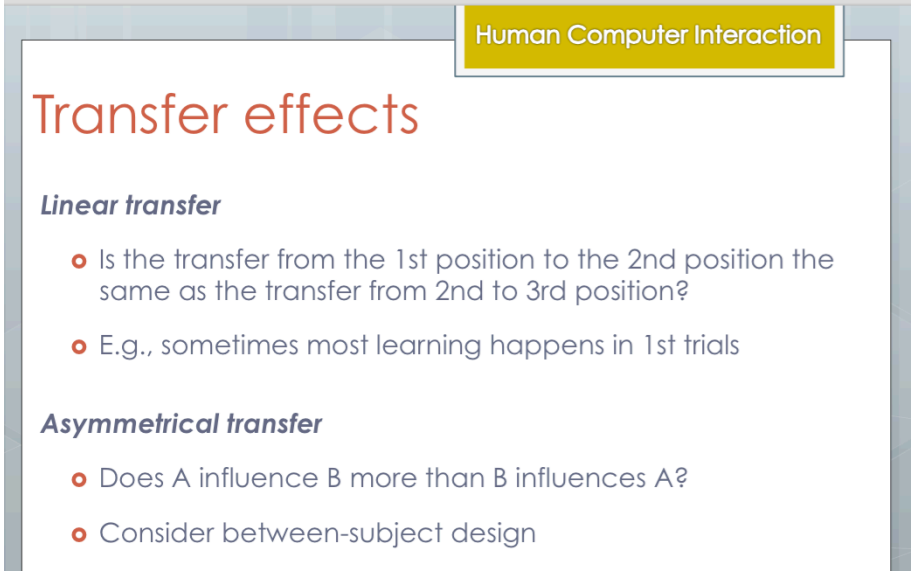
(2 marks)

See above for answer.

(f) Describe a technique that can be used to counteract linear transfer effects in a within-subjects experimental design?

(2 marks)

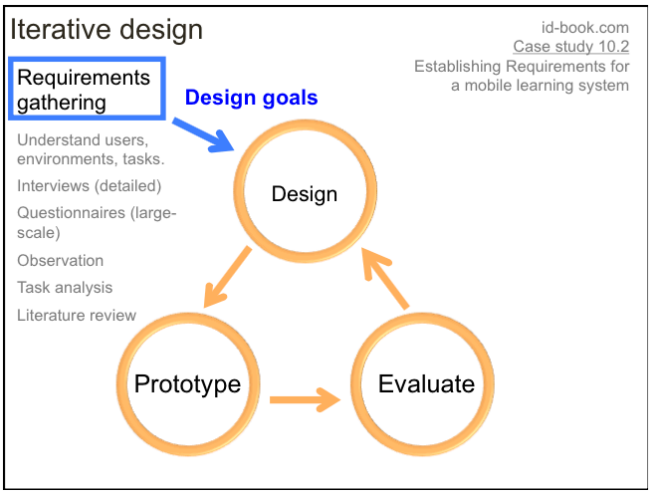




Answer the following questions on qualitative research and the interaction design process.

(a) What is the purpose of requirements gathering within an overall iterative design process?

(2 marks)



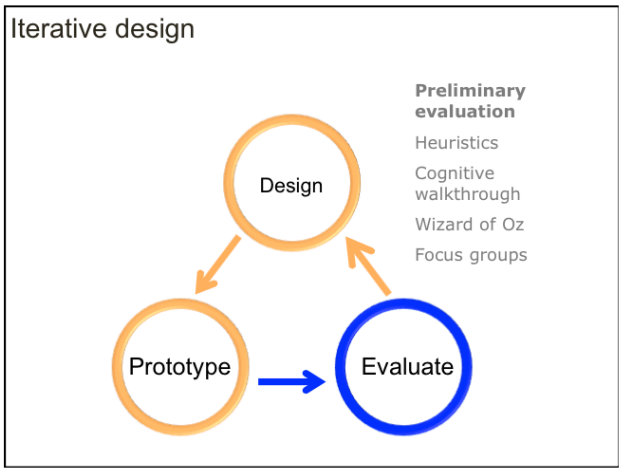
(b) Identify and describe the strengths and weakness of three requirements gathering techniques.

(6 marks)

Strengths and weakness of any of the above.

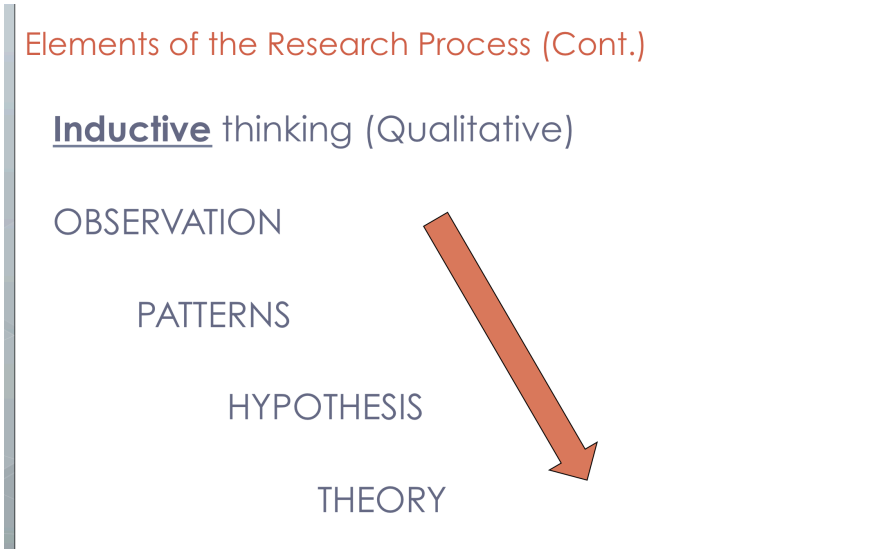
(c) Identify two evaluation techniques that are suitable for the formative stages of an iterative design process and two evaluation techniques that are more appropriate for a later summative evaluation stage.

(4 marks)



(d) Whereas quantitative research typically follows a deductive approach, qualitative research is more likely to follow an inductive approach. What are the four main stages in an inductive approach to research?

(4 marks)



(e) In qualitative research what is *coding* and what is the purpose of coding*?*

(4 marks)