CS_199
COMPUTERS UNPLUGGED
(*Attempt 2 questions out of 4*)

Question 1

Much of modern life depends heavily on computers, whether as conventional PCs in office environments or as embedded computers inside devices, from medical devices to entertainment boxes.

(a) Identify an important device of your choice that is critical to some aspect of modern life.

[5 mark]

(b) Identify and discuss three issues of its use, carefully relating them to computer science concerns.

[10 marks]

(c) Referring to the issues you have identified, or otherwise, discuss how better computer science would improve the device, society and the environment.

[10 marks]

Question 2

Sorting is a fundamental problem with many algorithms, with different merits.

(a) Outline the workings of ***one*** sorting algorithm of your choice.

[5 marks]

(b) Using this algorithm, concisely explain 3 advantages and 3 disadvantages of its use for sorting a national telephone directory into name order.

[20 marks]

Question 3

David Huffman introduced a practical algorithm for finding an efficient code given the expected frequency of occurrence of its symbols in any message.

(a) Explain why Huffman's algorithm was a significant historical breakthrough.

[10 marks]

(b) Answer ***one*** of the following:

(i) Explain how Huffman's (or similar) algorithms are used for the efficient transmission of faxes.

(ii) Explain how Huffman's (or similar) algorithms can be used to improve the efficiency of mobile phone user interfaces, or any other user interface of your choice.

[15 marks]

Question 4

This question refers to the ***pancake flipping problem*** which was studied in the lectures.

(a) What is the *definition* of the n^{th} ***pancake number*** P_n?

[3 marks]

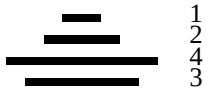
(b) What are the *values* of the first three pancake numbers P_1, P_2 and P_3?

[3 marks]

(c) For each of the following three pancake stacks, describe a sequence of flips which will sort them into tidy pyramids. Try to find the least number of flips necessary.

(i) 

(ii) 

(iii) 

[6 marks]

(d) Describe a procedure which will sort any stack of n pancakes using at most $2n-3$ flips.

Explain why this procedure will do no more than $2n-3$ flips.

[5 marks]

(e) Given an unordered stack of n pancakes (where n is at least 4), explain why you may have to use at least n flips to sort them.

[3 marks]

(f) Describe the ***pancake network***, and discuss how it satisfies the three desirable properties of *cheapness*, *fast communication* and *fault talerance*.

[4 marks]

(g) Which computing pioneer co-wrote the first scientific paper on the problem of pancake sorting?

[1 marks]