5CCS2FC2: Foundations of Computing II

Tutorial Sheet 10

10.1 An exam comprises two separate parts **Section A** and **Section B**. Section A comprises 10 multiple choice questions, each worth 5 marks and section B comprises 7 questions, each worth 6 marks.

On average, students answered 6.5 questions correctly on section A and 5 questions correctly on section B. However, there was a greater deviation in the number of correctly answered questions for Section A with a variance of 1.1, compared with a variance of 0.6 for Section B.

(i) What is the expectation and variance among all the exam marks?

(ii) The students also recieve 8 marks from a coursework assessment that is marked 'pass/fail', in which all students passed. How does this affect the expectation and variance of the combined coursework+exam grade?

10.2 Apply the Bucket Sort algorithm to the following list of numbers:

(i) 0.84, 0.98, 0.64, 0.63, 0.79, 0.58, 0.62, 0.26, 0.15, 0.33

(ii) 0.01, 0.00, 0.16, 0.28, 0.35, 0.10, 0.84, 0.49, 0.29, 0.06

(iii) 0.15, 0.95, 0.05, 0.88, 0.51, 0.25, 0.47

(iv) 0.60, 0.28, 0.70, 0.45, 0.46, 0.64, 0.39, 0.32, 0.57, 0.34, 0.71

Are there any instances where the Bucket Sort algorithm does not seem to be an appropriate sorting algorithm?

10.3 (i) Use the ideas employed in the bucket sort algorithm to construct an algorithm for sorting birthdays than has a *worst-case* time complexity of $O(n)$.

(ii) Why does this algorithm not run in linear-time for arbitrary lists of items?