Beijing-Dublin International College

Semester 2 Examination - 2018/2019

School of Computer Science

COMP 3018J Systems Design and Verification

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Time Allowed: 120 minutes

Instructions for Candidates

Please answer any 3 questions. Each question is worth 20 marks.

BJUT Student ID: _____ UCD Student ID: _____

I have read and clearly understand the Examination Rules of both Beijing University of Technology and University College Dublin. I am aware of the Punishment for Violating the Rules of Beijing University of Technology and/or University College Dublin. I hereby promise to abide by the relevant rules and regulations by not giving or receiving any help during the exam. If caught violating the rules, I accept the punishment thereof.

Honesty Pledge: _____

(Signature)

Instructions for Invigilators

1. (20 Marks).

The f function is defined as follows.

f : natural -> natural

* (0) f.0 = 0
* (1) f.1 = 1
* (2) f.(2*n) = f.n + 2 , 0 < n
* (3) f(2*n+1) = 2*f.n + 3*f.(n+1) + 4 , 0 < n

Given a natural number N construct a program to compute f.N

2. (20 marks).

Given f[0..N] of int, $1 \leq N$. We are guaranteed that f doesn't contain the value 0. We also know that f.0 = -3 and f.N = 42. Construct an efficient program to locate an index i in f, where f.i and f.(i+1) have opposite sign.

3. (20 marks).

Given f[0..N) of int. A Segment Sum in f is defined as follows.

$$SS.i.j = \langle + k : i \leq k < j : f.k \rangle \quad ,0 \leq i \leq j \leq N$$

Construct a program to compute the value of the largest Segment Sum in f.

4. (20 marks).

Given f[0..1000) of int, construct programs to do the following:

(i) Determine whether f only contains negative values.

(ii) Determine whether the array is ordered in descending order.

5. (20 marks).

Given f[0..500) of int, construct programs to do the following

(i) Compute the product of the values in the 2nd half of f.

(ii) Count the number of even values in f.