

National College of Ireland

**BSc (Hons) in Computing Year 3 (BSHC3)**

**BSc (Hons) in Computing, Evening Year 3 (BSHCE3)**

**MOCK EXAM -SOLUTIONS**

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**Advanced Programming**

**Answer Question A and one other question.**

**Duration of exam:** 120 minutes

**Attachments:**

**Question A. [60 marks]**

**Answer all parts of this question. Each part carries 10 marks.**

1. What is the worst-case complexity (Big O notation) of the following code fragment? Show your computation. [10 marks]

int fib (int N)

{

int f1, f2, f3;

f1 = 1

f2 = 1;

for (int j = 3; j <= N; j++) {

f3 = f1 + f2;

f1 = f2;

f2 = f3;

}

return f3;

}

1. Explain how the Big O notation is determined for a mathematical function. Exemplify the computation of Big O notation on the following function:

f(n) = 14n3 +n2 + 3 [10 marks]

1. Consider the below Bubble sort algorithm pseudo code. Assume the collection has the following elements {8 9 6 1 2 4 5}. What will the collection arrangement be after the second iteration of the outer loop? Explain your answer. [ 10 marks]

moreSwaps = true;

while moreSwaps is equal to true

{

moreSwaps = false;

for x = 0 up to numOfElements-1 do:

{

if elementAt(x) > elementAt(x+1)

{

swap(elementAt(x),elementAt(x+1))

moreSwaps = true;

}

}

}

1. Re-Write the pseudo code for the Insertion sort algorithm in order to sort the elements in descending order. [ 10 marks]
2. Present the principle behind the Sequential (linear) searching algorithm. [10 marks]
3. Describe how the concept of recursion is used in programming. [10 marks]

**Answer either Question B or Question C.**

**Question B [40 Marks]**

1. Discuss one solution that may be used to analyse the performance an algorithm in terms of
   1. methodology used
   2. advantages
   3. disadvantages

[20 marks].

1. Compute the Big O notation (growth rate) for the following functions: [10 marks]
   1. F(x) = x4+9x3+4x+7
   2. G(x) = 5 + 13x +xlog x
   3. F(n) = 2n-n2 +3
2. Provide details on how worse-case complexity (Big O notation) is computed for the Bubble sort algorithm provided bellow. [10 marks]

for i=0 up to numOfElements

{

for j=0 up to numOfElements -1-i

{

if elementAt(j) > elementAt(j+1)

{

swap (elementAt(j),element(j+1)

}

}

}

**Question C [40 Marks]**

1. Present the principle behind the Binary searching algorithm. [10 marks]
2. Consider that you have a collection of numbers represented as { 15, 23, 26, 41, 52, 70, 80 } and you are searching for number 23. Illustrate and explain step-by-step how Binary searching algorithm works on the given set of numbers. [10 marks]
3. Write the non-recursive based pseudo code or Java code for the Binary searching algorithm. **[**20 marks].