Maynooth University
National University of Ireland Maynooth

OLLSCOIL NA hÉIREANN MÁ NUAD

THE NATIONAL UNIVERSITY OF IRELAND MAYNOOTH

JANUARY 2016 EXAMINATION

CS210

Algorithms & Data Structures 1

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Time allowed: 2 hours

Answer all four questions

All questions carry equal marks

[20 marks]

1 Write a Java program given the following specification and provide comments which explain how your algorithm works.

Problem Statement
The goal is to read in a number and to output the nearest prime. If two primes are equidistant then output the lower one.

Input Format
An integer *N*.

Output Format
The closest prime to *N*.

Constraints
$2 \leq N \leq 10000$

Sample Input
3856

Sample Output
3853

[20 marks]

2 Write a Java program given the following specification and provide comments which explain how your algorithm works.

Problem Statement
The goal is to sort a list of words in reverse alphabetical order.

Input Format
The first line contains *N*, the number of words to be sorted, followed by a line with *N* words, each separated by a space.

Output Format
A line consisting of the words sorted in reverse alphabetical order, each separated by a space.

Constraints
$1 \leq N \leq 100$

Sample Input
3
one two three

Sample Output
two three one

[20 marks]

3 Write a Java program given the following specification and provide comments which explain how your algorithm works.

Problem Statement
Use a stack to check if a sentence is a palindrome or not. You must write your own Stack class. A palindromic sentence is one that reads the same forwards as backwards when you ignore all the spaces. Upper and lower case letters should be treated as equivalent. If the sentence is palindromic, output TRUE, otherwise output FALSE.

Input Format
An input string *S*.

Output Format
Either TRUE if *S* is a palindrome or FALSE otherwise.

Constraints
1≤length(*S*)≤100

Sample Input
Ten animals I slam in a net

Sample Output
TRUE

[20 marks]

4 a) Identify the output that the following Java code produces and explain your reasoning clearly. [10 marks]

```
public class Recursion{
    public static void main(String[] args){
        System.out.println(method(14));
    }

    public static int method(int number){
        if (number % 7 == 3){
            return 5;
        }
        System.out.println("hello");
        return method((number % 5) + 3) - 2;
    }
}
```

b) Identify the output that the following Java code produces and explain your reasoning clearly. [10 marks]

```
public class BitManipulation{
    public static void main (String[] args){
        System.out.println(((4|6)|(5&3))<<5);
    }
}
```