UNIVERSITY OF DUBLIN

XM34631

TRINITY COLLEGE

FACULTY OF SCIENCE

SCHOOL OF MATHEMATICS

JS/SS Maths/TSM

Michaelmas Term 2012

MATHEMATICS 1262: C++ PROGRAMMING: 3 SPECIMEN QUESTIONS

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Attempt 3 questions

SECTION II

5. (a) What does the following code do?

```
#include <iostream>
using namespace std;
int main()
{
 bool finished;
 double x, s1, s2, a, v;
 int n;
 s1 = s2 = 0;
 n = 0;
 finished = false;
 while ( ! finished )
  \{ cin >> x; \}
   if ( cin.eof() )
    { finished = true; }
    else
    { s1 += x;
      s2 += x*x;
      ++n;
    }
 }
 a = s1/n;
 v = (s2 - n*a*a)/(n-1);
```

```
cout << "n " << n << " a " << a << " v " << v << endl;
return 0;
}</pre>
```

ANSWER_

Reads in numbers x from input, stores their sum in s_1 , the sum squared in s_2 , and the number of items in n. The average s_1/n is stored in a. It prints out the sample variance.

(b) Describe in outline another program to compute the same quantities. ANSWER

There are two ways. One can either read in the numbers and store them in an array, or read the file twice, though that is not possible with cin. So read in the numbers, storing them in an array x_i — allowing for 1000 numbers, say — then compute the average a, and then compute $\sum_i (x_i - a)^2$.

(c) What are the advantages and disadvantages of the two methods? ANSWER

The first method reads the data once only without storing it, so it is more economical from that point of view. On the other hand, it is inaccurate, and the second method is numerically reliable.

6. (a) Write a program which reads lines from standard input and prints any line in which the word 'ladle' occurs. Note: the string class has a constructor taking a char * argument (C-style string). Also, string::find(string sub) returns the position of sub in the string, default string::npos. ANSWER______

```
#include <iostream>
#include <iostream>
#include <string>
using namespace std;
int main()
{
    bool finished;
    char buffer [200];
    string str;
```

```
finished = false;
while ( ! finished )
{
  cin.getline ( buffer, 200 );
  if ( cin.eof () )
    finished = true;
  else
    {
    str = string ( buffer );
    if ( str.find ( "ladle" ) < string::npos )
        cout << str << endl;
    }
}
return 0;
```

(b) Write the routines for the following class Vec3 etcetera. ANSWER

}

```
Vec3::Vec3 ( double xx, double yy, double zz )
{
    x = xx; y = yy; z = zz;
}
Vec3 Vec3::cross_prod ( Vec3 other )
{
    double xx, yy, zz;
    xx = y() * other.z() - z() * other.y();
    yy = z() * other.x() - x() * other.z();
    zz = x() * other.y() - y() * other.x();
    return Vec3(xx, yy, zz);
}
etcetera
```

7. (a) Simulate the following non-recursive routine, showing exactly what gets printed.

```
#include <iostream>
using namespace std;
int xxx ( int n )
{ int i, s;
   s = 0;
   for (i=0; i<n; ++i)
      s += 2*i + 1;
   return s;
}
int main()
{ cout << "xxx(3) is " << xxx ( 3 ) << endl;
   return 0; }</pre>
```

ANSWER____

n	S	i	
3	0		
	0	0	
	1		
	4	1	
	4	2	
	9		
		3	
Prints xxx(3)	is 9		

- (b) What does xxx(n) return in general, given $n \ge 0$? Answer n^2
- (c) Simulate the following recursive routine, showing exactly what gets printed.

```
#include <iostream>
using namespace std;
int yyy ( int n )
{ if ( n <= 9 )
    return 0;
    else
    return 1 + yyy ( n/10 );
}
int main()</pre>
```

(d) What does yyy(n) return in general, given $n \ge 1$? Answer $\lfloor \log_{10} n \rfloor$.

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