Math/CS 466/666 Calculus and Computer Literacy Survey

1. How many years ago did you take calculus? How many years ago did you take linear algebra? What was the most recent math course you took?

Subject	**School**	**Course**	**Year**
Calculus			
Linear Algebra			
Most Recent			

2. Do you have access to or own a computer where you can install software and write programs related to homework for this course?

Yes ◯ No ◯

3. You may have previous experience reading and writing computer programs. Please indicate which languages you are able to read and understand, which languages you are able to write and develop codes using, and which languages are available on a computer that you have access to outside of the university.

Language	**Reading**	**Writing**	**Access**
C/C++	Yes ◯ No ◯	Yes ◯ No ◯	Yes ◯ No ◯
CUDA/OpenCL	Yes ◯ No ◯	Yes ◯ No ◯	Yes ◯ No ◯
FORTRAN	Yes ◯ No ◯	Yes ◯ No ◯	Yes ◯ No ◯
Haskell	Yes ◯ No ◯	Yes ◯ No ◯	Yes ◯ No ◯
Maple	Yes ◯ No ◯	Yes ◯ No ◯	Yes ◯ No ◯
Matlab/Octave	Yes ◯ No ◯	Yes ◯ No ◯	Yes ◯ No ◯
Pascal/Ada	Yes ◯ No ◯	Yes ◯ No ◯	Yes ◯ No ◯
Python	Yes ◯ No ◯	Yes ◯ No ◯	Yes ◯ No ◯

4. Which of the operating systems have you used, which are you an expert using and which have you installed or reinstalled yourself.

Program/OS	**Used**	**Expert**	**Installed**
GNU/Linux	Yes ◯ No ◯	Yes ◯ No ◯	Yes ◯ No ◯
Mac OS X	Yes ◯ No ◯	Yes ◯ No ◯	Yes ◯ No ◯
MinGW/Cygwin	Yes ◯ No ◯	Yes ◯ No ◯	Yes ◯ No ◯
MS Windows	Yes ◯ No ◯	Yes ◯ No ◯	Yes ◯ No ◯
Plan 9	Yes ◯ No ◯	Yes ◯ No ◯	Yes ◯ No ◯

5. Find the following derivatives and integrals:

(i) $\dfrac{d}{dx}\sin(x^2)$

(ii) $\displaystyle\int \sin(2x)dx$

6. Write the repeating decimal $1.\overline{34}$ as a fraction.

7. Convert the hexidecimal number `1CA` to a decimal.

8. Find the nullspace $N(A) = \{ x \in \mathbf{R}^2 : Ax = 0 \}$ of the 2×2 matrix given by

$$A = \begin{bmatrix} 1 & -2 \\ -1 & 2 \end{bmatrix}$$

9. State Taylor's theorem and then derive or prove it.

10. The Riemann zeta function is a complex function defined by the infinite series

$$\zeta(s) = \sum_{n=1}^{\infty} \frac{1}{n^s} \qquad \text{for} \qquad s \in \{\, x + iy : x > 1 \,\}.$$

(i) Write a computer program to approximate this sum.

(ii) Describe how you would determine how many terms to take in the infinite series for a good approximation.

11. The following C/C++ program has an error.

```
1  #include <stdio.h>
2  int main(void){
3      double cels;
4      printf("%15s %15s\n","Celsius","Fahrenheit");
5      for(cels=-10;cels<31;cels+=10){
6          double fahr=9/5*cels+32;
7          printf("%15.2f %15.2f\n",cels,fahr);
8      }
9      return 0;
10 }
```

It is supposed to print a Celsius to Fahrenheit conversion chart, but instead of printing the correct table

```
Celsius      Fahrenheit
 -10.00           14.00
   0.00           32.00
  10.00           50.00
  20.00           68.00
  30.00           86.00
```

it prints

```
Celsius      Fahrenheit
 -10.00           22.00
   0.00           32.00
  10.00           42.00
  20.00           52.00
  30.00           62.00
```

Identify the bug, explain what happened and correct it.

12. Consider the following C/C++ program.

```
1  #include <stdio.h>
2  int c=1,d=-2;
3  int f(int d){
4      return d*c++;
5  }
6  int main(void){
7      int d=c++;
8      int c=++d;
9      {
10         c=f(++c);
11         int c=5;
12     }
13     printf("c = %d\n",c);
14     return 0;
15 }
```

(i) Although this program is ridiculous, what output does it produce?

c = [ ]

(ii) Suppose line 8 of the code above is changed so it reads

```
8      c=++d;
```

Now what output does it produce?

c = [ ]

(iii) Explain your answers to parts (i) and (ii) using the terms scope and sequence point. Note, I promise not to put such examples on real tests. Please don't write programs like this for me to grade, either.