Do not use the computer in any way for this part of the quiz. Also keep your book and notes closed.

1. State Taylor's theorem with remainder for a scalar function in one variable.

2. State the trapezoid method for computing a definite integral.

3. Define the condition number cond(A) of a matrix A.

4. Suppose

$$A = \begin{bmatrix} 1 & -2 & 3 & -4 \\ 5 & -4 & 3 & -2 \\ 1 & 0 & 1 & 0 \\ 0 & 2 & -7 & 1 \end{bmatrix} \qquad \text{and} \qquad x = \begin{bmatrix} 1 \\ 2 \\ -3 \\ 1 \end{bmatrix}.$$

(i) Find $\|x\|_1$

(ii) Find $\|x\|_\infty$

(iii) Find $\|A\|_1$

(iv) Find $\|A\|_\infty$

5. Solve one of the following:

(i) Prove that Newton's method is quadratically convergent. You may assume that the initial guess x_0 is close to the root c of f and that $f'(c) \neq 0$.

(ii) Show that the power method converges to the eigenvalue of largeset magnitude. You may assume A is an $n \times n$ matrix and has n distinct eigenvalues such that the eigenvalue of largest magnitude is unique.

Please use the Ubuntu VM for this part of the quiz. You may also use your notes and textbooks as well as online resources such as Wikipedia and Google. However, do not use email or any other messaging service.

Submit your program and output using the commands

```
/nfs/home/ejolson/opt/bin/submit -q1 program.c
/nfs/home/ejolson/opt/bin/submit -q2 output.txt
```

Here `program.c` is the name of your program and `output.txt` is an output file obtained by running the program with the command

```
./a.out >output.txt
```

If you wish to change any part of your submission simply retype the appropriate submit command again. You may check each of your submissions with the command

```
/nfs/home/ejolson/opt/bin/submit -pn
```

where `n` is equal the number used in submit command.

6. Please answer one of the following questions.

(i) Write or modify a C computer program to implement Newton's method and use it to approximate the solution $cos(x^2) = x$ starting with an initial guess of $x^0 = 0.5$. Print the first 5 iterations of the method.

(ii) Write or modify a C computer program to use the trapezoid quadrature method to approximate $\int_0^2 \sin(x^2)dx$ using $n = 20$ subdivisions.