ECE 595 (Numerical Simulations) - Quiz 1

Turn in during next class, or scan and email to pbermel@purdue.edu

Due Wednesday, March 20, 2013 at 2:20 pm

1. Provide 3 examples of numerical problems in class **P**.

2. Provide 3 examples of numerical problems in class **NP**.

3. Provide 2 examples of **NP** problems that can be solved in **P** time.

4. Is Gauss-Jordan elimination more stable with or without pivoting, and why?

5. What is the significance of Crout's algorithm?

6. What is the fastest and simplest numerical algorithm to find the largest eigenvalue of a generalized square matrix?

7. Name three reasonable strategies for diagonalizing a generalized square matrix.

8. How quickly can the Newton-Raphson method converge on a root with a sufficiently good guess?

9. Does Brent's method always converge in 1D, and why?

10. Is optimization faster for convex or non-convex problems, and why?

11. How can a Laplacian operator be represented as a matrix? Please indicate the basis used.

12. What theorem allows us to use discrete Fourier transforms much like the continuous versions?

13. What are three reasonable methods to identify resonant frequencies in discrete time data?

14. With the beam propagation method: when is it appropriate to drop the second-order derivative in the z-direction?

15. Give two examples of finite element shape functions in 1D.

16. What are two physical effects that allow one to tune the performance of optical devices?

17. Why would one use the Scharfetter-Gummel scheme to solve for current transport?

18. How do you construct reciprocal lattice vectors in 3D?

19. What is the tight-binding method?

20. What do LDA and GGA represent in density functional theory?