

# 620-361 Operations Research Techniques and Algorithms

## Practice Class 5

1. How can you tell if a matrix is positive definite, positive semi-definite, negative definite or negative semi-definite?
2. (a) Name two ways to calculate, from a given matrix, whether it is positive definite.  
(b) Which way is quickest for a 2x2 and 3x3 matrix?
3. In the context of what we have been studying, why is it sometimes important to have a positive definite matrix?
4. What do we mean by 'full rank'?
5. What is an affine function? Give an example.
6. What do we mean when we say a function is  $C^1$  or  $C^2$ ?
7. What is the Jacobian matrix?
8. What is the Hessian matrix?
9. Why is unimodality a concern?
10. When would you use Fibonacci search?
11. When would you use Golden Section search?
12. When would you use the Method of False Position?
13. When would you use Newton's method for 1D problems?
14. What do we mean by 'step size'? What is this used for?
15. How can you tell if a function is convex?
16. Why is it sometimes important for a function to be convex?
17. What do we mean when we say  $\|x^k - x^*\|$ ?
18. What do we mean when we say  $\|\nabla f(x^k)\|$ ?
19. What do we mean by 'rate of convergence'?
20. When performing a direct search, what are some suitable stopping criteria?
21. When would you use Newton's method for n-D problems?
22. When would you use BFGS for  $n$ -D problems?

23. When would you use the Lagrange method?
24. When would you use the Karush-Kuhn-Tucker conditions?
25. How do we solve the KKT conditions?
26. When would you use a penalty method?