This assignment is due at the **start** of your lecture/tutorial on Friday, 21 March 2014.

1. [10 marks]

   Assume that $f : \mathbb{D} \to \mathbb{R}$ is continuously differentiable for all $x \in \mathbb{D}$, where the domain $\mathbb{D}$ of f is an open, convex subset of $\mathbb{R}^n$. Show that f is convex on $\mathbb{D}$ if and only if

   $$f(y) \geq f(x) + \nabla f(x)^T (y - x)$$

   for all x and $y \in \mathbb{D}$.

   Also show that f is strictly convex on $\mathbb{D}$ if and only if

   $$f(y) > f(x) + \nabla f(x)^T (y - x)$$

   for all x and $y \in \mathbb{D}$ for which $x \neq y$.

   [Several students used this result in Question 1 of Assignment 2 without proving it.]

2. [10 marks]

   Do question 4.2 on page 98 of your textbook.

   Plot the contours of the Rosenbrock function and include on the graph the points x_k produced by your dogleg method.

   Hand in your program and your plot.

3. [10 marks]

   Do question 4.6 on page 99 of your textbook.

4. [10 marks]

   Do question 4.7 on page 99 of your textbook.

   In addition to showing that $\|p\|$ increases along the double-dogleg path also show that

   $$m(p) = f + p^T g + \frac{1}{2} p^T B p$$

   decreases along the double-dogleg path.

   [This is similar to the result that I mentioned in class for the dogleg path.]

5. [10 marks]

   Do question 4.8 on page 99 of your textbook.

6. [10 marks]

   Do question 4.12 on page 100 of your textbook.