MATH693A Homework 1

Name:

Problem 1a(i)

Newton Method				
$x_0 = [1.2 \, ; \, 1.2]^T$, Stopping Criteria: $\|\nabla f\| < 10^{-8}$				
Present here the <u>first</u> 6 values from your iterations for the variables in the Table				
Iteration # k	$\bar{x}_k{}^T$	$f(\bar{x}_k)$	$\bar{p}_k{}^{SD}$	α_k
0				
1				
2				
3				
4				
5				
6				

Problem 1a(ii)

Newton Method				
$x_0 = [1.2 \, ; \, 1.2]^T$, Stopping Criteria: $\|\nabla f\| < 10^{-8}$				
Present here the <u>last</u> 6 values from your iterations for the variables in the Table				
Iteration # k	$\bar{x}_k{}^T$	$f(\bar{x}_k)$	$\bar{p}_k{}^{SD}$	α_k

Problem 1a(iii)

Newton Method				
$x_0 = [-1.2 \, ; \, 1]^T$, Stopping Criteria: $\|\nabla f(\bar{x}_k)\| < 10^{-8}$				
Present here the <u>first</u> 6 values from your iterations for the variables in the Table				
Iteration # k	$\bar{x}_k{}^T$	$f(\bar{x}_k)$	$\bar{p}_k{}^{SD}$	α_k
0				
1				
2				
3				
4				
5				
6				

Problem 1a(iv)

Newton Method
$x_0 = [-1.2 \; ; \; 1]^T$, **Stopping Criteria:** $\|\nabla f(\bar{x}_k)\| < 10^{-8}$
Present here the <u>last 6</u> values from your iterations for the variables in the Table

Iteration # k	$\bar{x}_k^T$	$f(\bar{x}_k)$	$\bar{p}_k^{SD}$	α_k

Problem 1a(v)

Steepest Descent Method
$x_0 = [1.2 \; ; \; 1.2]^T$, **Stopping Criteria:** $\|\nabla f(\bar{x}_k)\| < 10^{-8}$
Present here the <u>first 6</u> values from your iterations for the variables in the Table

Iteration # k	$\bar{x}_k^T$	$f(\bar{x}_k)$	$\bar{p}_k^{SD}$	α_k
0				
1				
2				
3				
4				
5				
6				

Problem 1a(vi)

Steepest Descent Method
$x_0 = [1.2 \; ; \; 1.2]^T$, **Stopping Criteria:** $\|\nabla f(\bar{x}_k)\| < 10^{-8}$
Present here the <u>last 6</u> values from your iterations for the variables in the Table

Iteration # k	$\bar{x}_k^T$	$f(\bar{x}_k)$	$\bar{p}_k^{SD}$	α_k

Problem 1a(vii)

Iteration # k	$\bar{x}_k^T$	$f(\bar{x}_k)$	$\bar{p}_k^{SD}$	α_k
	Steepest Descent Method			
	$x_0 = [-1.2 \; ; \; 1]^T$, Stopping Criteria: $\|\nabla f(\bar{x}_k)\| < 10^{-8}$			
	Present here the <u>first</u> 6 values from your iterations for the variables in the Table			
0				
1				
2				
3				
4				
5				
6				

Problem 1a(viii)

Iteration # k	$\bar{x}_k^T$	$f(\bar{x}_k)$	$\bar{p}_k^{SD}$	α_k
	Steepest Descent Method			
	$x_0 = [-1.2 \; ; \; 1]^T$, Stopping Criteria: $\|\nabla f(\bar{x}_k)\| < 10^{-8}$			
	Present here the <u>last</u> 6 values from your iterations for the variables in the Table			

Problem 1b(i)

Present here the number of iterations number of iterations required in order to achieve convergence

Line Search Method	Stopping Criteria	Number of iterations required in order to achieve convergence
Newton Method		
$x_0 = (1.2, 1.2)^T$	$\|\nabla f(\bar{x}_k)\| < 10^{-8}$	
$x_0 = (1.2, 1.2)^T$	$\|f(\bar{x}_k)\| < 10^{-8}$	
$x_0 = (-1.2 \; ; \; 1)^T$	$\|\nabla f(\bar{x}_k)\| < 10^{-8}$	
$x_0 = (-1.2 \; ; \; 1)^T$	$\|f(\bar{x}_k)\| < 10^{-8}$	
Steepest Descent Method		
$x_0 = (1.2, 1.2)^T$	$\|\nabla f(\bar{x}_k)\| < 10^{-8}$	
$x_0 = (1.2, 1.2)^T$	$\|f(\bar{x}_k)\| < 10^{-8}$	
$x_0 = (-1.2 \; ; \; 1)^T$	$\|\nabla f(\bar{x}_k)\| < 10^{-8}$	
$x_0 = (-1.2 \; ; \; 1)^T$	$\|f(\bar{x}_k)\| < 10^{-8}$	

Problem 1b(ii)

Discuss your observation with regards to number of iterations required in order to achieve convergence:

Problem 2(i) and (ii)

Present the graphs for Problem 2 here. Don't forget to label the axis of your graph. Your graph should have a title.

Problem 2(iii)

Compare the graph obtained in (i) with the one obtained in (ii). What can you infer about the convergence of the steepest descent and Newton algorithm.

Problem 3(a)

Determine if the following function of two variables is convex. You must show work to receive credit.

Problem 3(b)

Create surface and contour plot of the function using a programming language of your choice. Paste images of your plot below

Problem 4(i) and (ii)

Present your solution below

Problem 5

Present your solution below

Problem 6

Present your solution below