Name: _____ ID: _____

Department of Computer Science and Engineering

CSE330: Numerical Methods

Summer 2018

Quiz-1 **SET B**

Full Marks: 15 **Time: 20minutes**

Solve $x = \tan x$ using **Newton Raphson's** method upto **3** iterations and fill up the table below. Given initial guess, $x_i = 4.6$.

Iteration Count	x_i	$\lvert\epsilon_a\rvert\%$	$f(x_i)$	$f'(x_i)$
1	4.54573	1.1939%	-1.3989	-35.34
2	4.5061	0.8795%	-0.2725	-22.835
3	4.4942	0.2648%	-.01602	-20.34

$f(x) = x - \tan x = 0$

$f'(x) = \frac{d}{dx}(x - \tan x) = \frac{d}{dx}(x) - \frac{d}{dx}(\tan x)$

$= 1 - \sec^2 x$

$= 1 - \frac{1}{\cos^2 x}$

$= 1 - \frac{1}{(\cos x)^2}$

Iteration 1 :-

$x_0 = 4.6$

$x_1 = x_0 - \frac{f(x_0)}{f'(x_0)} = 4.6 - \frac{f(4.6)}{f'(4.6)}$

$= 4.6 - \frac{4.6 - \tan(4.6)}{1 - \left(\frac{1}{\cos 4.6}\right)^2}$

$= 4.54573$

$f(x_1) = f(4.54573)$

$= 4.54573 - \tan(4.54573)$

$= -1.3989$

$f'(x_1) = f'(4.54573)$

$= 1 - \left(\frac{1}{\cos(4.54573)}\right)^2$

$= -35.34$

$|\text{tal}| = \left|\frac{x_1 - x_0}{x_1}\right| \times 100\% = \left|\frac{4.54573 - 4.6}{4.54573}\right| \times 100\%$

$= 1.1939\%$

Iteration 2:

$x_2 = x_1 - \frac{f(x_1)}{f'(x_1)}$

$= 4.54573 - \frac{-1.3989}{-35.34}$

$= 4.5061$

$f(x_2) = f(4.5061) = 4.5061 - \tan(4.5061)$

$= -0.2725$

$f'(x_2) = f'(4.5061) = 1 - \left(\frac{1}{\cos(4.5061)}\right)^2$

$= -22.835$

$|\text{tal}| = \left|\frac{x_2 - x_1}{x_2}\right| \times 100\% = \left|\frac{4.5061 - 4.54573}{4.5061}\right| \times 100\%$

$= 0.8795\%$

Iteration 3: $x_3 = x_2 - \frac{f(x_2)}{f'(x_2)} = 4.5061 - \frac{-0.2725}{-22.835}$

$= 4.4942$

$f(x_3) = f(4.4942) = 4.4942 - \tan(4.4942) = -0.01602$

$f'(x_3) = f'(4.4942) = 1 - \left(\frac{1}{\cos 4.4942}\right)^2 = -20.34$

$\therefore |\text{tal}| = \left|\frac{x_3 - x_2}{x_3}\right| \times 100\% = \left|\frac{4.4942 - 4.5061}{4.4942}\right| \times 100\%$