King Fahd University of Petroleum & Minerals
Department of Mathematics & Statistics
Math 372 Major Exam 1 2018-2019 (Term181)
Time Allowed: 90 Minutes

Write all steps clear.

Problem 1. (15 points)

First find Maclaurin expansions for $f(h) = \cos(h^2)$ and $g(h) = \ln(1 + h)$ of order 8 and 4 respectively. Then experiment and find the order of approximation for their sum.

Problem 2. 20 points)

a) Show that $g(x) = \frac{1}{3}xe^x$ has a unique fixed point on [-2, 0]

b) Estimate the number of iterations required to achieve 10^{-6} accuracy (assuming $p_0 = \frac{1}{2}$).

Problem 3. (15 points)

a) Use Bisection method to find a solution that is accurate to within 10^{-1} for $2x\cos(2x) = (1+x)^2, \quad for \ -1 \le x \le 0$

b) Let $f(x)$ is continuous on the interval [a, b] and the minimum value of f is 2, what happens to the Bisection method?

Problem 4. (15 points)

a) Use Secant method to find a solution for

$$x - 0.8 - 0.2\sin x = 0, \quad for \ 0 \le x \le \frac{\pi}{2}, \ (\ p_0 = 0, p_1 = \frac{\pi}{4}, \text{find } p_3 \ )$$

b) Use newton's method to approximate $\sqrt{2+\sqrt{2}}$, with $p_0 = 1.7$

Problem 5. (15 points)

a) Construct the Lagrange interpolating polynomial that agrees with the following data (1, 1), (0, 1), and (-1, 3)

b) If we add the point (k, 3), what values of k must be taken that the degree will stay the same.

Problem6. (20 points)

Write a MATLAB code to approximate the solution of the equation $sinx = e^{-x}$.

$0 \le x \le 1$, by using Secant method with $p_0 = 0, p_1 = 0.5$ and possible error 0.01.