دانشکده مهندسی برق
گروه کنترل

بنام آنکه جان را فکرت آموخت

روشهای محاسبات عددی

تمرین اول

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مدرس : رسول دلیرروی فرد

1.Compute the absolute error and relative error in approximations of p by p^*.

a. $p = e^{10}$, $p^* = 22000$ b. $p = \pi$, $p^* = \frac{22}{7}$ c. $p = 8!$, $p^* = 39900$

2. Find the second Taylor Polynomial $P_2(x)$ for the function $f(x) = e^x \cos(x)$ about $x_0=0$.

a. Use $P_2(0.5)$ to approximate f(0.5). Find an upper bound for error $|f(0.5)-P_2(0.5)|$ using the error formula , and compare it to the actual error.

b. Find a bound for the error $|f(0.5)-P_2(0.5)|$ in using $P_2(0.5)$ to approximate f(x) on the interval [0,1] .

c. Approximate $\int_0^1 f(x)dx$ using $\int_0^1 P_2(x)dx$.

d. Find an upper bound for the error in (c) using $\int_0^1 |R_2(x)dx|$, and compare the bound to the actual error.

3. The polynomial $P_2(x) = 1 - \frac{1}{2}x^2$ is to be used to approximate f(x)=cos(x) in interval [-0.5,0.5]. Find a bound for the maximum error.

4. Find intervals containing solutions to the following equations (with theorem). Also for parts (c) , (d) find rational roots and number of positive or negative roots.

a. $x - 3^{-x} = 0$ b. $4x - e^x = 0$ c. $x^3 - 2x^2 - 4x + 3 = 0$ d. $x^3 + 4.001x^2 + 4.002x + 1.101 = 0$

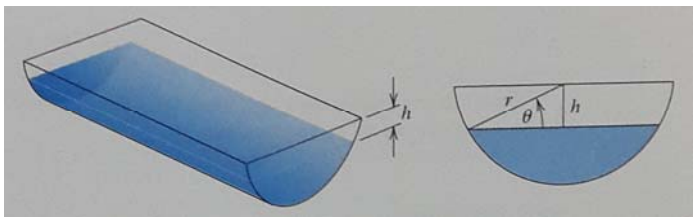
5. Use the Secant & False Position & Modified False Position Methods to find solutions accurate to within 10^{-4} for the following equation.

$$x - \cos(x) = 0 \quad \text{on} \quad [0, \frac{\pi}{2}]$$

6. A trough of length L has a cross section in the shape of a semicircle with radius r. When filled with water to within a distance h of the top, the volume, V, of water is

$$V = L\left[0.5\pi r^2 - r^2 \arcsin(\frac{h}{r}) - h\sqrt{(r^2 - h^2)}\right]$$

Suppose L = 10ft , r = 1ft and V=12.4 ft^3. Find the depth of water in trough to within 0.01 ft with Newton-Raphson Method.



7. Use Modified Newton-Raphson method (one & two state) to approximate the solutions of the following equation with 8 digit precision in the given interval.

$$x^2 - 2xe^{-x} + e^{-2x} = 0 \quad \text{on} \quad [0,1]$$

8. Write a C program for Bairstow Method and use following Example :

$x^4 - 3.1x^3 + 2.1x^2 + 1.1x + 5.2$ Beginning with the trial factor $x^2 - 4x + 5$

Find factors with 3-digit precision .