Numerical Analysis 10E
Chapter 02 Sample Exam

Name (Print): ____________________

1. (10 points) The equation $f(x) = x^2 - 2e^x = 0$ has a solution in the interval [-1,1].
   (a) (5 points) With $p_0 = -1$ and $p_1 = 1$ calculate p_2 using the Secant method.
   (b) (5 points) With p_2 from part (a) calculate p_3 using Newton's method.

2. (15 points) The equation $f(x) = 2 - x^2 \sin x = 0$ has a solution in the interval [-1,2].
   (a) (5 points) Verify that the Bisection method can be applied to the function $f(x)$ on [-1,2].
   (b) (5 points) Using the error formula for the Bisection method find the number of iterations needed for accuracy 0.000001. Do not do the Bisection calculations.
   (c) (5 points) Compute p_3 for the Bisection method.

3. (15 points) The following refer to the fixed-point problem
   (a) (5 points) State the theorem which gives conditions for a fixed-point sequence to converge to a unique fixed point.
   (b) (5 points) Given $g(x) = \dfrac{2 - x^3 + 2x}{3}$, use the theorem to show that the fixed-point sequence will converge to the unique fixed-point of g for any p_0 in [-1,1.1].
   (c) (5 points) With $p_0 = 0.5$ generate p_3.

4. (10 points) Suppose the function $f(x)$ has a unique zero p in the interval [a, b]. Further, suppose $f''(x)$ exists and is continuous on the interval [a,b].
   (a) (5 points) Under what conditions will Newton's Method give a quadratically convergent sequence to p?
   (b) (5 points) Define quadratic convergence.

5. (10 points) Let $g(x) = \dfrac{2 - x^3 + 2x}{3}$ on the interval [-1, 1.1]. Let the initial value be 0 and compute the result of 2 iterations of Stefffensen's Method to approximate the solution of $x = g(x)$.

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