Instructions for preparing the solution script:

- Write your name, ID#, and Section number clearly in the very front page.
- Write all answers sequentially.
- Start answering a question (not the pat of the question) from the top of a new page.
- Write legibly and in orderly fashion maintaining all mathematical norms and rules. Prepare a single solution file.
- Start working right away. There is no late submission form. If you miss the deadline, you need to use the make-up assignment to cover up the marks.

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1. Consider a function $f(x) = x^3 + x^2 - 4x - 4$.
   (a) (3 marks) Compute the minimum number of iterations required to find the root if the machine epsilon(error bound) is 1×10^{-2} and the interval is [-10, -1.5].
   (b) (4 marks) Show 5 iterations using the Bisection Method to find the root of the above function within the interval [-10, -1.5].
   (c) (2 marks) State the exact roots of $f(x)$ and construct two different fixed point functions $g(x)$ such that $f(x) = 0$.
   (d) (3 marks) Compute the convergence rate of each fixed point function $g(x)$ obtained in the previous part, and state which root it is converging to or diverging.
2. Consider the following function: $f(x) = xe^x - 1$.
   (a) (3 marks) Find solution of $f(x) = 0$ up to 5 iterations using Newton's method starting with $x_0 = 1.5$. Keep up to four significant figures.
   (b) (4 marks) Consider the fixed point function, $g(x) = \frac{2x+1}{\sqrt{x+1}}$. Show that to be super-linearly convergent, the root must satisfy x* = $\frac{-3}{2}$.
3. (a) (3 marks) Consider the function $f(x) = x^2 - x + 1$ and starting point $x_0 = 0$. Show that the sequence using Newton's method x1, x2, $\cdots$ fails to approach a root of $f(x)$.
   (b) (4 marks) Consider the function $f(x) = cos(2x) - sinx$. Compute the solution of the function, such that f(x) = 0, using Newton's method with Aitken's acceleration and starting point, $x_0 = 0$. Consider up to five decimal places.[Error bound is 1×10^{-3}]

Motto: Mathematics is NOT difficult, but what is difficult is to believe that mathematics is NOT difficult.