CS 3113 A5

1) $f(x) = e^x/(x-2)$

1)a) $f'(0.66)$

$e^x/(x-2) = e^x(x-2)^{-1}$

$f'(x) = f'g + fg' = e^x(x-2)^{-1} + e^x(x-2)^{-2}(-1)$

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

$$f'(0.66) = \frac{e^{(0.66)}}{(0.66-2)} - \frac{e^{(0.66)}}{(0.66-2)^2} = -2.521393441$$

1)b) $f'(0.66)$ CDF $h = \underline{0.1}, \underline{0.05}, \underline{0.025}$ abs err $O(h^2)$

$h = 0.1$

$$f'(0.66) = \frac{f(0.66+0.1) - f(0.66-0.1)}{2(0.1)}$$

$$= \left(\frac{e^{0.76}}{-1.24} - \frac{e^{0.56}}{-1.44}\right) \Big/ 2(0.1)$$

$$= -2.543357575$$

abs err $= |(-2.543357575) - (-2.521393441)|$

$= 0.021964134$

$h = 0.05$

$$f'(0.66) = \frac{f(0.66+0.05) - f(0.66-0.05)}{2(0.05)}$$

$$= \left(\frac{e^{0.71}}{-1.29} - \frac{e^{0.61}}{-1.39}\right) \Big/ 2(0.05)$$

$$= -2.526860438$$

$$\text{abs err} = |(-2.526860438) - (2.521393441)$$
$$= 0.005466997$$

$h = 0.025$

$$f'(0.66) = \frac{f(0.66+0.025) - f(0.66-0.025)}{2(0.025)}$$

$$= \left(\frac{e^{0.685}}{-1.315} - \frac{e^{0.635}}{-1.365}\right) \Big/ 2(0.025)$$

$$= -2.522758696$$

$$\text{abs err} = |(-2.522758696) - (-2.521393441)|$$
$$= 0.001365255$$

$h \to 2^{\circ}(0.1) = 2^{1}(0.05) = 2^{2}(0.025)$

abs err $\to 0.21964134 \simeq 4^{1}(0.005466997) \simeq 4^{2}(0.001365255)$

$$= 0.21964134 \simeq 0.021867988 \simeq 0.02184408$$

$\therefore O(h^2)$

1)c) $f'(0.66)$ RE $h_1 = 0.1$ $h_2 = 0.05$ abs err

$F = f'(x)$

$$F_2(0.05) = \frac{f(0.66+0.05) - f(0.66-0.05)}{2(0.05)}$$

$$= \left(\frac{e^{0.71}}{(0.71-2)} - \frac{e^{0.61}}{(0.61-2)} \right) \Big/ 2(0.05)$$

$$= -2.526860438$$

$$F_2(0.1) = \frac{f(0.66+0.1) - f(0.66-0.1)}{2(0.1)}$$

$$= \left(\frac{e^{0.76}}{(0.76-2)} - \frac{e^{0.56}}{(0.56-2)} \right) \Big/ 2(0.1)$$

$$= -2.543357575$$

$$F_4(h) = \frac{2^2(-2.526860438) - (-2.543357575)}{2^2 - 1}$$

$$= -2.521288667$$

$$\text{abs err} = |(-2.521288667) - (-2.521393441)|$$

$$= 0.000104774$$