ESO 208A: Computational Methods in Engineering

**Tutorial 9**

Interpolation

1. For the following data, interpolate the value of function $f(x)$ at $x = 0.275$ by (a) Lagrange polynomials and (b) Newton's divided difference. Perform interpolation using first, second and third order polynomials.

| $x$ | $f(x)$ |
|-----|--------|
| 0.1 | 0.99010 |
| 0.2 | 0.96154 |
| 0.3 | 0.91743 |
| 0.4 | 0.86207 |
| 0.5 | 0.80000 |

If the actual function is $f(x) = \dfrac{1}{1+x^2}$, estimate the true relative error in interpolation by the different order polynomials.

Cubic splines

2. Consider the function $f(x) = \exp(x)$ sampled at points $x = 0$, 0.5, 1.0, 1.5 and 2. Estimate the function value at $x = 1.80$ by interpolating the function using - (a) natural cubic spline and (b) not-a-knot cubic spline. Calculate the true percentage error for both the splines. Which is the better spline for this problem and why?