Summer 2025

MATH 4650-E01
CSCI 4650-E01
MATH 5660-E01

Homework 4

Due on Monday July 7th 2025

Exercises:

1. EX.3.1.1.b2c handwritten
2. EX.3.1.2.b2c handwritten
3. EX.3.1.4 handwritten
4. EX.3.1.6 handwritten
5. EX.3.1.8 handwritten
6. EX.3.1.10 handwritten
7. EX.3.1.18 colab
8. CP.3.1.4 colab
9. EX.3.2.2 handwritten

EX.3.1.1.b2c, Sauer3

Use Lagrange interpolation to find a polynomial that passes through the points

b. $(-1, 0), \quad (2, 1), \quad (3, 1), \quad (5, 2).$

c. $(0, -2), \quad (2, 1), \quad (4, 4).$

EX.3.1.2.b2c, Sauer3

Use Newton's divided differences to find the interpolating polynomials of the points in EX.3.1.1.b2c, and verify agreement with the Lagrange interpolating polynomial.

b. $(-1, 0), \quad (2, 1), \quad (3, 1), \quad (5, 2).$

c. $(0, -2), \quad (2, 1), \quad (4, 4).$

EX.3.1.4, Sauer3

a. Find a polynomial $p(x)$ of degree 3 or less whose graph passes through the points $(0, 0)$, $(1, 1)$, $(2, 2)$, $(3, 7)$.

b. Find two other polynomials (of any degree) that pass through these four points.

c. Decide whether there exists a polynomial $p(x)$ of degree 3 or less whose graph passes through the points $(0, 0)$, $(1, 1)$, $(2, 2)$, $(3, 7)$, and $(4, 2)$.

EX.3.1.6, Sauer3

Write down a polynomial of degree exactly 5 that interpolates the four points $(1, 1)$, $(2, 3)$, $(3, 3)$, $(4, 4)$.

EX.3.1.8, Sauer3

Let $p(x)$ be the degree 9 polynomial that takes the value 112 at $x = 1$, takes the value 2 at $x = 10$, and equals zero for $x = 2, \ldots, 9$. Calculate $p(0)$.

EX.3.1.10, Sauer3

Let $p(x)$ be the degree 5 polynomial that takes the value 10 at $x = \ 1,\ 2,\ 3,\ 4,\ 5$ and the value 15 at $x = 6$. Find $p(7)$.

EX.3.1.18, Sauer3

The expected lifetime of an industrial fan when operated at the listed temperature is shown in the table that follows. Estimate the lifetime at 70°C by using (a) the parabola from the last three data points (b) the degree-3 curve using all four points.

temp (°C)	hrs (×1000)
25	95
40	75
50	63
60	54

Please use COLAB for this problem.
No handwritten work! Please turn in a Colab Notebook

CP.3.1.4, Sauer3

Remodel the `sin1` calculator key in Program 3.3 to build `cos1`, a cosine key that follows the same principles. First decide on the fundamental domain for cosine.

EX.3.2.2, Sauer3

a. Given the data points $(1, 0)$, $(2, \ln(2))$, and $(4, \ln(4))$, find the degree 2 interpolating polynomial.

b. Use the result of (a) to approximate $\ln(3)$.

c. Use Theorem 3.3 to give an error bound for the approximation in part (b).

d. Compare the actual error to your error bound.