

DUE : MARCH 16, 2009

1. Using the built-in MATLAB functions **conv** and **poly**, write a MATLAB function **lgrnintp** in the following format:

$$\text{function } [P, Z] = \text{lgrnintp}(X, Y),$$

where  $X$  and  $Y$  are vectors containing respectively  $x$ - and  $y$ -values,  $P$  is the vector containing the coefficients of the Lagrangian interpolating polynomial and  $Z$  is the vector containing values of the interpolating polynomial at the nontabulated points  $x = z$ .

Data for Problem 1

1.  $f(x) = \cos x$

$x$	$y$
0	1
1	0.5403
2	-0.4161
3	-0.9900
4	-0.6536
5	0.2837

2.  $f(x) = e^{-x}$

$x$	$y$
0	1
1	.3679
2	0.1353
3	0.0498
4	0.0183
5	0.0067

### Presentation of Results

The results should be presented in the following format:

**TABLE 1: Results for Lagrangian Interpolation**

$P$ : The coefficient of the interpolation polynomial	$z$	$P(z)$	$f(z)$	Error = $f(z) - P(z)$
	0.5			
	2.5			
	3.5			
	4.5			

### Practice with MATLAB Functions

2. MATLAB function **interp1** in the form

$$YI = \text{interp1}(X, Y, Z, 'method')$$

interpolates to find  $YI$  at the values contained in the vector  $Z$  from a table of values of  $X$  and  $Y$  ( $X$  and  $Y$  are vectors containing the  $x$ - and  $y$ -values). The available methods are:

- nearest** - nearest neighbor interpolation
- linear** - linear interpolation
- spline** - cubic spline interpolation
- cubic** - cubic interpolation.

Using this function and each of the available methods, find the approximate values of both the functions  $\cos x$  and  $e^{-x}$  at the points contained in the vector  $Z$  of TABLE 1.

Compare the results with those obtained by Lagrangian method and write your observations.

3. Write the output of the following program:

```
x = 0 : 20; y = e^x; xi = 0 : .50 : 10;
yi = interp1 (x, y, xi);
plot (x, y, 'o', xi, yi).
```