Matlab Homework 5*a*

In the online book:

- Do the "Challenge Activities" of: 5.6
- Do the "Participation Activities" of: 4.4,6-8; 6.7

Matlab Homework 5*b*

The same general requirements as for homework 4b apply. And you must study the posted lesson(s) and have done the online book part above before you can ask a TA or the instructor for help.

1. You are still considering the problem of interpolating a function f that, "unknown to you," is exactly equal to

$$f_{\text{exact}}(t) = \frac{1}{2} + \sin\left(\frac{t}{2}\right) + \frac{1}{3}e^{t/3}$$

but you only have values at 8 equally spaced times from -3 to 3. (Note that the solutions to the previous homework are now online. Check what you did wrong before starting this homework.)

This time, try fitting a straight line, a cubic, and a quintic to the data.

Like in the previous homework, evaluate the three fitted values at times -3.5, -1.5, 0, 1.5, and 3.5. (Note: Do each of these times separately, one after the other). Print the obtained values and their errors out in the format

```
At t =  1.1:
the linear  fit is  1.123, with error 1.12E12;
the cubic   fit is  1.123, with error 1.12E12;
the quintic fit is  1.123, with error 1.12E12.
```

using a `fprintf` for each line. The numbers should line up as shown. Make sure not to put any data numbers in the fprintf format strings.

Like in the previous homework, plot the exact and measured values and add the linear (magenta), cubic (cyan), and quintic (green) curves. The same completeness requirements apply for the plot. Use `disp` commands to compare the results with each other.

Finally, print out the maximum errors in the plot range and in the interpolation range as

```
The maximum error in the interpolation range is:
   for the linear  fit: 1.12E12;
   for the cubic   fit: 1.12E12;
   for the quintic fit: 1.12E12;
The maximum error in the plot range is:
   for the linear  fit: 1.12E12;
   for the cubic   fit: 1.12E12;
   for the quintic fit: 1.12E12;
```

2. Repeat the previous question, but now use 64 equally spaced noisy measurements instead of 8. Use `disp` commands to comment on the differences.

   To create the noisy data, Octave users can now use `randn` like the Matlab ones,

   ```
   rng('default')
   fMeasured=fExactFun(tMeasured)+0.1*randn(size(tMeasured));
   ```

   but skip `rng`. With this many measured points, it should not make much of a difference.

   Make sure to generate *all* data from scratch. Use a `clear` command before running `q2` to be sure.

3. Continuing the previous question, integrate the linear and spline interpolates and the three fitted curves from a starting point $t_1 = -1$ to an end point $t_2 = 3$. Compare with the exact result

   $$\int_{t_1}^{t_2} f_{\text{exact}}(t)\,\mathrm{d}t = \frac{1}{2}(t_2 - t_1) - 2\cos\left(\frac{t_2}{2}\right) + 2\cos\left(\frac{t_1}{2}\right) + e^{t_2/3} - e^{t_1/3}$$

   Print out the results as

   ```
   For the integral with exact value 1.12345678
   linear interpolation  gives 1.123, with error 1.12E12;
   spline interpolation  gives 1.123, with error 1.12E12;
   the straight line fit gives 1.123, with error 1.12E12;
   the cubic  curve  fit gives 1.123, with error 1.12E12;
   the quintic curve fit gives 1.123, with error 1.12E12.
   ```