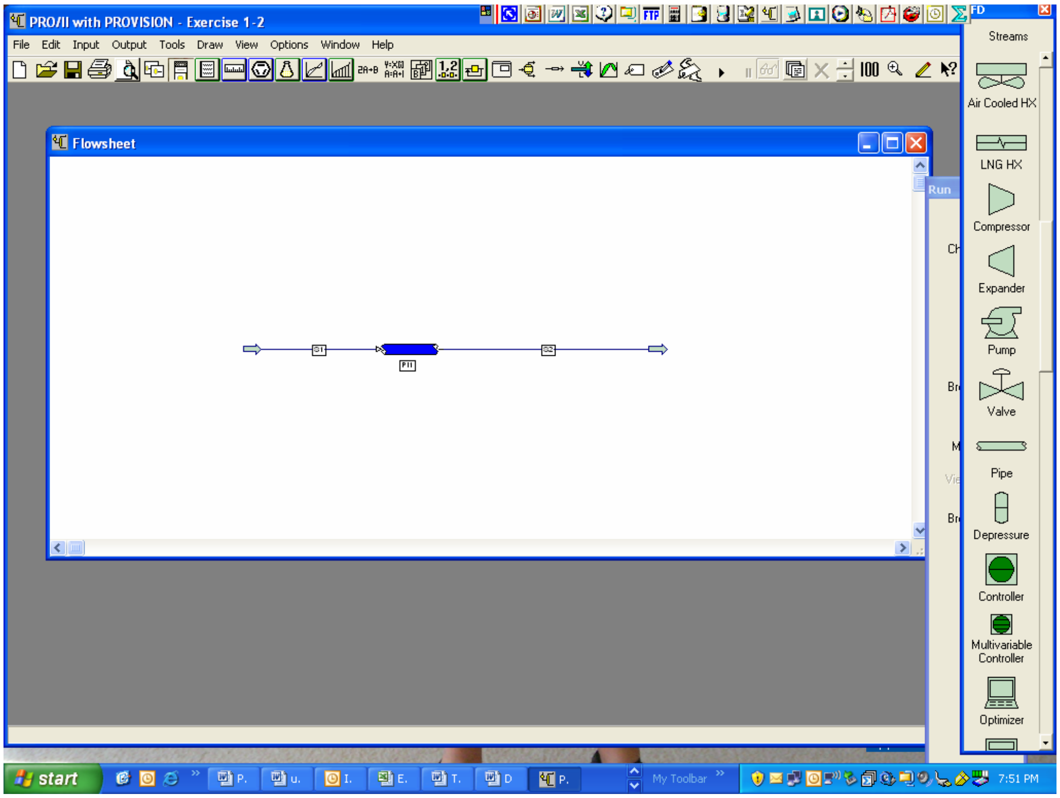
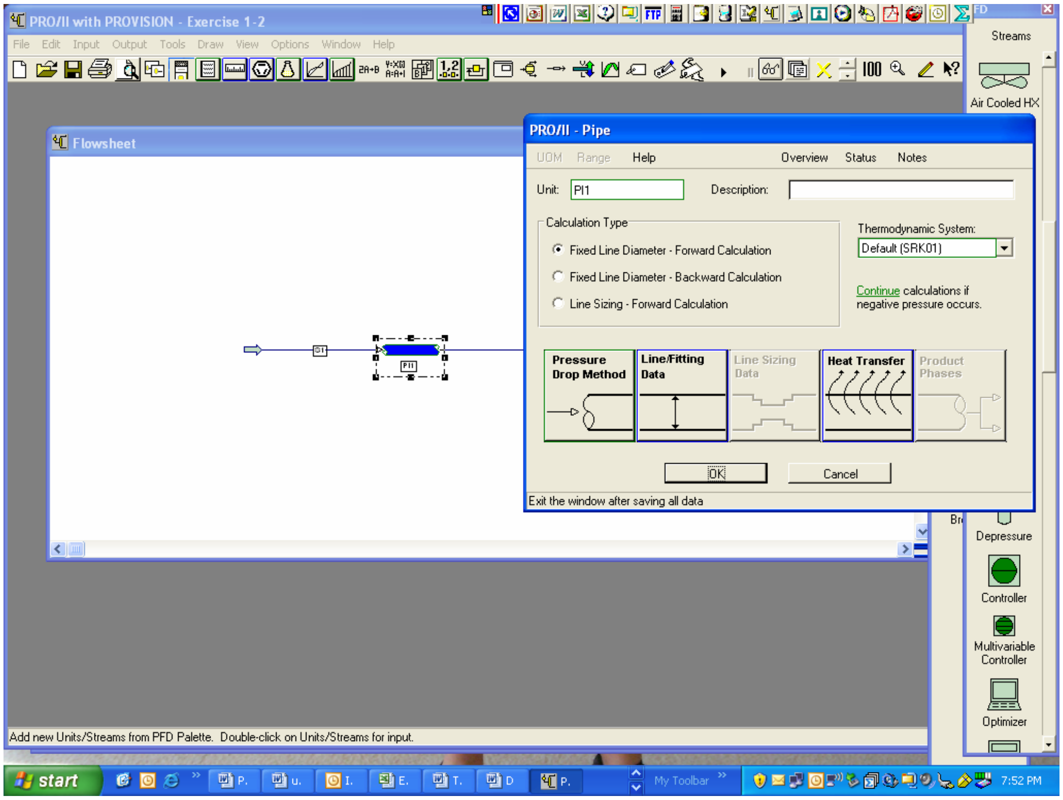
PIPELINE ENGINEERING

Pipeline Simulation

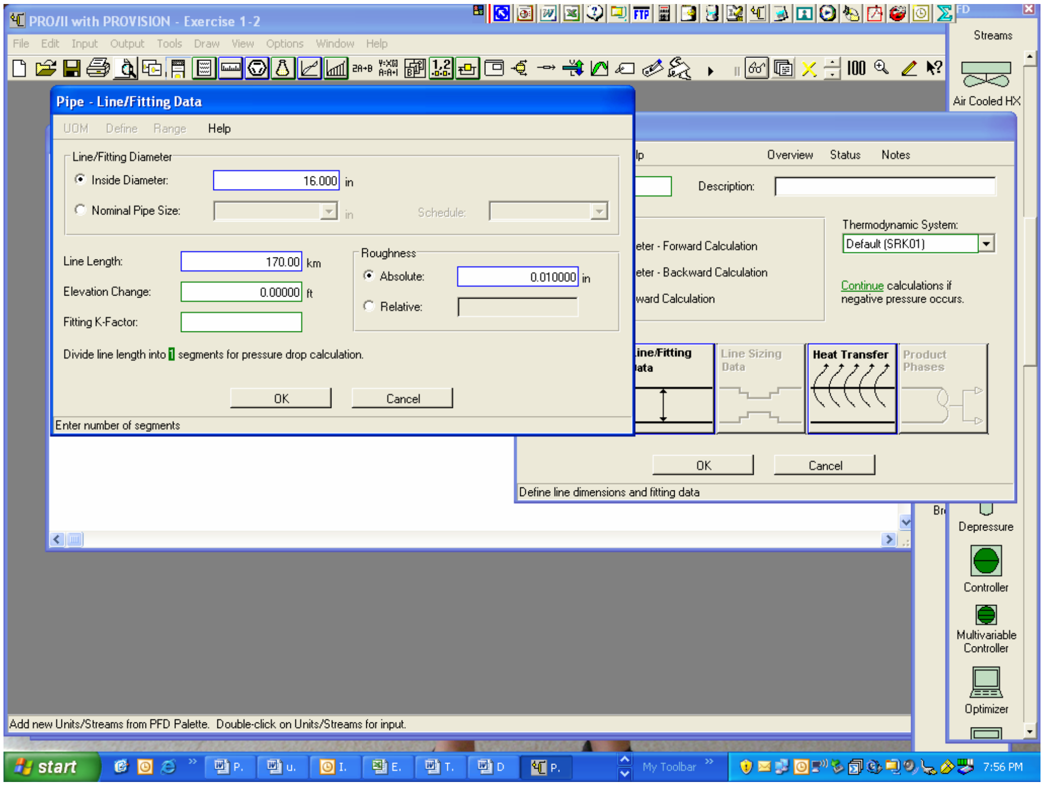
We start a simulation by entering a pipe in the simulator, as follows:



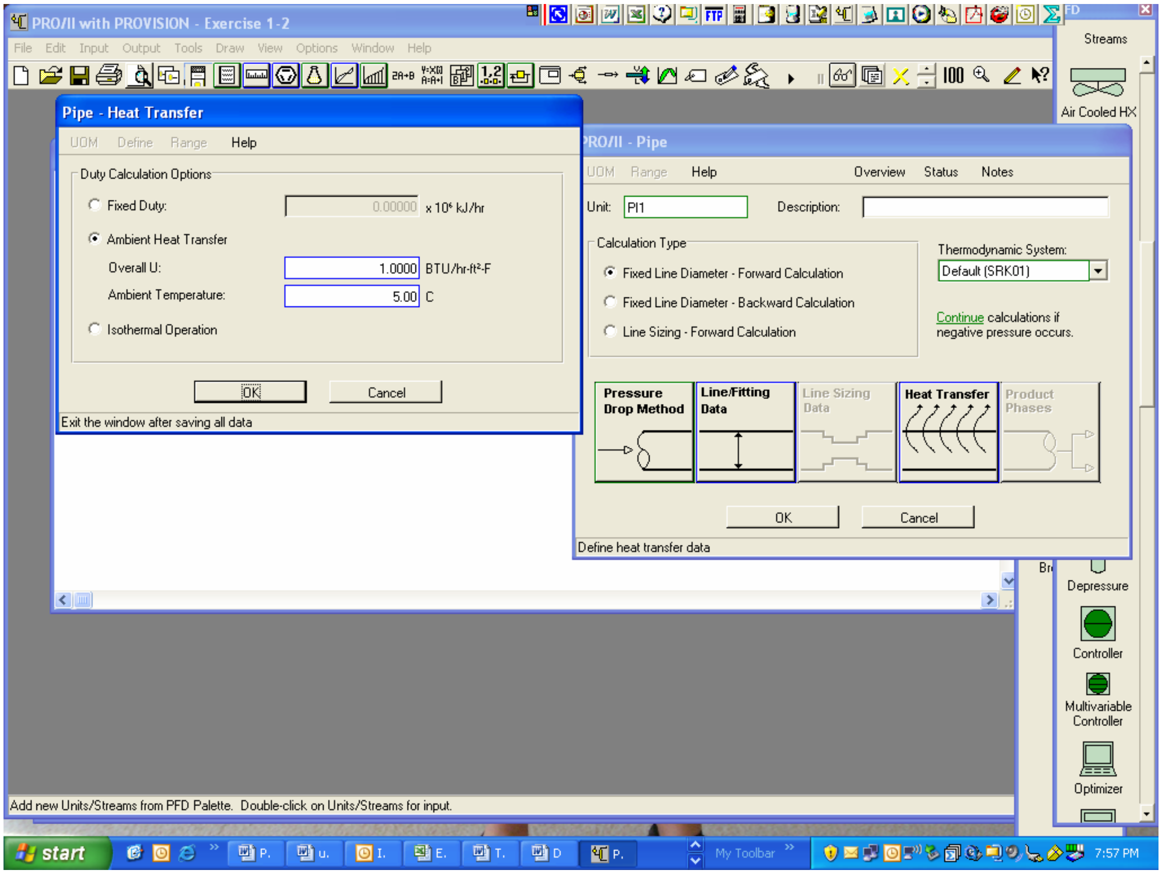
After clicking in the pipe, we reach the menu of input data



We enter the data of exercise 1-2 and the line fitting data:



Finally, for heat transfer, we enter a typical value.



Exercise 1-6:

Set up the simulator to calculate the pressure drop of the pipeline in exercise 1-2.

- Discuss with the instructor the choices of pressure drop correlations available.
- Compare the results with those obtained using the Panhandle A equation.
- Remove the acceleration term and compare results.
- Ask the simulator to perform calculations on more than one segment and compare results.
- Discuss the conditions of liquid water formation. At what location water starts to form?

  To answer this question, you need to replace this pipe by a sequence of several pipes.
- Determine if in this pipe there exist conditions of hydrate formation. Can ethane or propane segregate and form their own hydrates? If so, add methanol at the appropriate place and determine the effect on pressure drop.
- Consider different external temperatures and repeat the exercise. At what external temperature, there is no water condensation or hydrate formation?

Exercise 1-7:
Set up the simulator to calculate the work of the compressor in exercise 1-3
- Obtain the outlet temperature and CR
- Set up a series of compressors with after coolers and confirm that the optimal CR for these compressors is the same for all of them.
- Add a pressure drop to the after-coolers in each compressor and determine by inspection the optimal temperature at the outlet of the first compressor.
- Vary the CR and the temperature of both compressors to obtain the optimum.
- The instructor will introduce the optimizer to do this optimization automatically after you are finished.

We now discuss the general problem of the long pipeline. For long distances, one needs to determine, Size of recompression stations and number of compressors.

- Diameter: This will determine the pressure drop, which is recommended to be between 15 and 25 kPa/Km (3.5 to 5.85 psi/mile). However, this could be used as a starting point for optimization purposes.
- Velocity: This should be limited by the erosional velocity. This velocity is given by:

$$V_e = \frac{C}{\sqrt{\rho}} \tag{1-1}$$

where the constant C is between 75 and 150 (density in lb/ft^3 and velocity in ft/sec). For gas transmission pipelines C=100 is recommended.

Exercise 1-8:
Set up the simulator to simulate/design a Gas Pipeline from Ensenada to the California Middle valley. The distance is 500 miles. The pipeline is supposed to deliver gas to a number of locations, but for simplicity, we assume that no such locations will be served and that all 6.21 10^6 SCFD will be delivered to final destination. The proposed operating pressure is 1200 psia. Assume the gas is available at that pressure. The gas is to be brought from south America and its composition is 91.5%, 5.5% ethane, 0.8% propane, 0.5 % butane, 0.2% pentanes, 1.5 % nitrogen.
- Fix the diameter at the recommended value (use recommended pressure drop values).
- Determine how many recompression stations are needed.

