Transparency in Learning and Teaching: An Equity Intervention

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ENGR 7 – Programming Applications for Engineering [2020-21]

Exploring Logical Statements TILTed

Purpose: The purpose of the assignment is to (1) explore conditional statements in MATLAB (2) demonstrate your problem-solving approach within context-rich problems (3) demonstrate proficiency in using *if-else* structures to select and execute code

Student Learning Outcomes addressed in this assignment:

1. Identify, formulate, and solve computational problems using a methodical approach.
2. Design algorithms and flowcharts to facilitate programming and problem solving.
3. Design and document computer programs in a careful and complete manner to facilitate analysis and debugging by another programmer, and to anticipate and resolve errors.

Sample Problem:

Imagine that you want to buy gasoline. Write a program that will 1) asks the user whether he or she wants to request the gasoline in liters or in gallons, 2) prompts the user to enter how many units he or she wants to buy 3) calculates the total cost to the user, assuming that gasoline costs $3.89 per gallon.

```
clear,clc
%Define the cost per gallon
rate = 3.89;
%Ask the user to input gallons or liters
unit = input('Enter gallons or liters\n ','s');
%Use a switch/case to determine the conversion factor
switch unit
case 'gallons'
factor = 1;
case 'liters'
factor = 0.264;
otherwise
disp('Not available')
factor = 0;
end
%Ask the user how much gas he/she would like to buy
volume = input( ['Enter the volume you would like to buy in ',unit,': \n'] );
%Calculate the cost of the gas
if factor ~= 0
cost = volume * factor*rate;
%Send the results to the screen
fprintf('That will be $ %5.2f for %5.1f %s\n',cost,volume,unit)
end
```

Scalar Diffusion TILTed

Purpose: The purpose of this assignment is to 1) demonstrate your proficiency with 2-dimensional and 3-dimensional plotting tools in MATLAB 2) solve a non-linear multi-variable expression.

Student Learning Outcomes addressed in this assignment:

1. Identify, formulate, and solve computational problems using a methodical approach.

2. Create and apply MATLAB computer programs to analyze data and to generate tables, charts, and graphs.

Criteria: The rubric for this problem is below. The total points for the assignment is 300 points.

	Competent	Developing	Needs Improvement
Analytical	Thoughtfully translates an idea and solves the problem thoroughly (75)	Some steps are inaccurate (45)	Many steps are inaccurate (15)
Collegial	Documents programming approach in a careful complete manner (75)	documentation is mostly appropriate (45)	documentation is incomplete and/or unclear (15)
Graphical	creates visual representation to solve problems (75)	visual representation is unclear or missing important information (45)	visual representation is incomplete (15)

Sample Problem: The work produced by a piston–cylinder device depends on the pressure inside the cylinder and the amount the piston moves, resulting in a change in volume inside the cylinder. We can model most combustion gases as air and assume that they follow the ideal gas law:

PV = nRT

If we assume that there is 1 mole of gas at 300 K and that the temperature stays constant during the process, we can use these equations to calculate the work either done on the gas or produced by the gas as it expands or contracts between two known volumes(v0 = 1 m3 and vf = 5 m3). Also, create a PV plot and estimate the area under the curve.

Solution:

```
syms P V n R T V1 V2                          %Define variables
ideal_gas_law = sym(P*V == n*R*T)             %Define ideal gas law
P = solve(ideal_gas_law,P)                    %Solve for P
W = int(P,V,V1,V2)                            %Integrate P wrt V from V1 to V2
Work = double(subs(W,{n,R,V1,V2,T},{1,8.314,1,5,300.0}))


p = subs(P,{n,R,T},{1,8.314,300})
ezplot(p,[1,5])                               %Plot the pressure versus V
title('Pressure Change with Volume for an Isothermal System')
ylabel('Pressure, psia')
xlabel('Volume, cm^3')
axis([1,5,0,2500])
```

Why do we practice equity?

Exploring Logical Statements

	White	Asian	LatinX	Black
TILT	100 [2]	73.1 [8]	73.1 [7]	86.7 [1]
nonTILT	94.4 [3]	70.8 [4]	44.4 [6]	N/A

Scalar Diffusion

	White	Asian	LatinX
TILT	70 [2]	67.5 [8]	56.7 [6]
nonTILT	66.7 [3]	37.5 [4]	50 [6]

[TILT = Spring 2021; nonTILT = Winter 2021]