0 + name	
1	
2	
3	
4	
5	
6	
total	

(Note: This is worth **2 points** if done fully correctly. No partial credit.)

Your Name: Version a Key

Section Time/Section #: ________/________

Your TA's Name: ________________

Version a

Problem 1. [9 points] For each of the following situations, indicate the most appropriate kind of plot or graph.

a. You have measured the buckling load of steel rods of various diameters, and you want to compare it with the theoretical load predicted by a well-known formula.

- A bar chart with two bars for each diameter, showing the measured and predicted buckling loads for that diameter.
- A scatter (x-y) plot showing measured values (x=diameter, y=load), and also showing a smooth curve of the formula for the predicted load at all diameters.
- A set of pie charts, one for each diamter, showing what fraction of the rods of that diameter buckled at the predicted load.
- A series of histograms, one for each rod diameter, showing the number of rods of that diameter that buckled at each load.

b. You have surveyed CS 221 students about how much time they spent working on problem set 3, and you want to show the distribution of that time.

- A scatter (x-y) plot showing individual points (x=number of students, y=amount of time).
- A histogram with bar height indicating the number of students who spent each amount of time, with "buckets" of size one hour, from 0 up to the maximum of 12 hours.
- A pie chart with a "slice" for each student, with the size of the slice indicating the amount of time that student spent.
- A Pareto chart, with bars indicating the number of students who spent each amount of time, and a curve indicating the cumulative percentage of students who spent up to that amount of time.

either

c. You want to compare monthly manufacturing output between 2009 and 2010.

- A scatter (x-y) plot with individual points (x=month & year, y=number of units manufactured).
- A histogram, with bar height indicating the number of months in the two-year span in which production was at a given level.
- Two pie charts, each with 12 slices, showing the fraction of each year's output produced in each month.
- A bar chart with bar height indicating number of units produced, with two different-colored bars for each month, one for 2009 and one for 2010.

Problem 2. [25 points] Each box below shows the contents of a single MATLAB script, which will be executed with an empty workspace. Each script has at least one error. Indicate and explain all the problems.

(a)
```
for m = 1:5
   x = x + 1;
end
```
x is not initialized

(b)
```
x = 4;
while x < 10
   x = x + 1;
   if x > 5
      x = 5;
   end
end
```
this does not terminate

(c)
```
V = [5 10 15 20 25];
sum = 0;
for i=1:length(V)+1
  sum = sum + V(i);
end
```
out of bounds when i=6

(d)
```
V = [0, 1, 2, 3];
for i=1:length(V);
  V(i-1) = V(i) + V(i+1);
end
```
out of bounds when i = length(V)

out of bounds when i = 1

(e)
```
function y = cube(x)
   cube = x*x*x;
end
```
should be y

Problem 3. [10 points] Write down the value of the variable V after the following script executes:

```
V = [1 0 2 1 3];
R = V;
for i=2:length(V)-1
    R(i) = V(i-1)+V(i)+V(i+1);
    R(i) = R(i)/3;
end
V = R;
```

V: 1, 0, 2, 1, 3

R: 1, ~~0~~, ~~2~~, 1, 3
1, 1, 1, 2, 3

R = [1 1 1 2 3]

Problem 4. [16 points] Next to each root-finding method below, write the letters of *all* the characteristics (below) that apply to it.

Newton's Method e

Bisection Method [a], d,

Fixpoint Method b

MATLAB's **roots()** function [a], c, f, g

a. Guaranteed to converge.

b. Diverges if magnitude of the slope of the function exceeds 1.

c. Only works with equations involving polynomials.

d. Requires knowledge of an interval containing at least one root.

e. Diverges if the slope of the slope of the function is close to zero.

f. Does not require any initial guess.

g. Returns all roots.

Problem 5. [20 points] Consder the following sequence of MATLAB commands:

```
A = [1    2    0; 2    4    5; 3    -1    7];
B = [1    0    0; 0    1    0;  0    0    1];
C = [ 2    1; 9    5;  3  7];
D = [1      3;    2     5];
E = [1      7;   -1     3];
F = [10 20 30;   100  200 100];
```

Compute the results of the following MATLAB commands. If the operation is not defined for the given operands, write "error".

a. A + B [2 2 0; 2 5 5; 3 -1 8]

b. A - C error

c. D * E [-2 16; -3 29]

d. C' + F [12 29 33; 101 205 107]

(1+ -3) (7+9)
(2-5) (14+15)

$$\begin{bmatrix} 2 & 1 \\ 9 & 5 \\ 3 & 7 \end{bmatrix}' = \begin{bmatrix} 2 & 9 & 3 \\ 1 & 5 & 7 \end{bmatrix}$$

Problem 6. [10 points] Partial code for a MATLAB implementation of the bisection method is below. Fill in the blanks with the correct code. (Note: the code assumes that initially `f(xlow)` and `f(xhi)` have opposite signs.)

```
function root = bisect( f, xlow, xhi, ebound )
  error_est = abs(xlow-xhi)/2;
  flow = f(xlow);
  fhi  = f(xhi);
  while error_est > ebound
      root = (xlow + xhi)/2;
      froot = f(root);
      if froot*flow > 0
       % froot same sign as flow
        xlow = root;
        flow = froot;
      else
        xhi = root;
       [fhi = froot]; <------ optional
      end
      error_est = abs(xhi - xlow)/2;
  end
  root = (xhi + xlow)/2;
end
```