Table of Contents

Exam 3 Solution

```
CHEN 3600 - Tim Placek (placetd@auburn.edu)
All Rights Reserved (c) Copyright 2012


clear;
clc;
format compact;
```
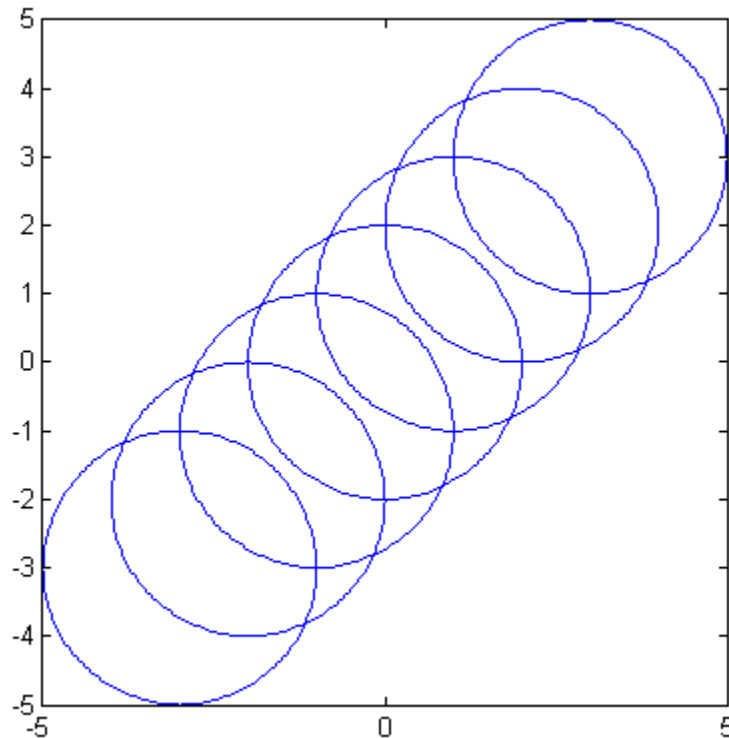
Problem (1)

```
claimed_strength = 800;
cord_strength = [784 802 789 794 803 808 786 810 804 797 796 795 794 ...
    798 798 806 813 802 795 804];
[H p] = ttest(cord_strength, claimed_strength, 0.01, 'right')
%{
    H = 0  that is, the null hypothesis cannot be rejected, accept null.

(a)  At a 99% confidence level, the data do not support that the cord
     strength supplied by this supplier is at least 800.
(b)  p = 0.7352     and p is not less than alpha (0.01)
(c)  In the context of this problem, an error would be made in 1% of
     the cases where samples of 20 cords were selected and tested from
     a distribution with a population mean breaking strength of 800 lbs.
     We would mistakenly judge the population mean was greater than 800
     lbs rather than correctly judging they came from a population with
     a mean of only 800 lbs.
     That is, we would reject a true null hypothesis.
%}
% NOTE:  Rerun with claimed_strength 700.


H =
    0
p =
    0.7352
```

Problem (2)

```
for k = -3:3
    [x y] = make_circle(2,k,k);
    plot(x,y)
    hold on
```

```matlab
end
axis([-5,5,-5,5])
axis square
hold off
```


Problem (3) Explain Question

```matlab
%{
Some researchers say that a hypothesis test can have one of two outcomes:
you accept the null hypothesis or you reject the null hypothesis.
Many statisticians, however, take issue with the notion of "accepting
the null hypothesis." Instead, they say: you reject the null hypothesis
or you fail to reject the null hypothesis.

Explain the difference between accepting the null hypothesis and failing
to reject the null hypothesis.  Consider the needs of an engineer who is
employing a hypothesis test.  Provide an answer that is both concise
and clear.

Answer:  Null hypothesis are never accepted. We either reject them or
fail to reject them. The distinction between "acceptance" and
"failure to reject" is best understood in terms of confidence intervals.
Failing to reject a hypothesis means a confidence interval contains a
value of "no difference". However, the data may also be consistent
with differences of practical importance. Hence, failing to reject H0
does not mean that we have shown that there is no difference (accept H0).

By way of analogy, the judgement of a jury is one of two outcomes both
relating to the null hyposthesis (the person is NOT guilty):
```

```
(1) The jury finds the defendant NOT GUILTY, that is, the evidence does
NOT (beyond a reasonable doubt) demonstrate the accused is guilty
(failure to reject the null) and we judge the person NOT GUILTY

(2) The jury finds the defendant GUILTY, that is, he evidence DOES support
the claim that the person IS guilty.

At no time in the above outcomes do we ACCEPT anything (such as the
innocence of the person).

In a practical sense (rather than a statistical sense), we are not
observing the chance event of sampling from a distribution and merely
noting that we can control (or select a critical value) to account for the
behavior of random samples, but instead we apply the hypothesis test (WITH
an alternative hypothesis) because we are seeking guidance in making a
decision with an implied action.  The "action" is associated with
"acceptance."
%}
```

Problem (4) ode45 Tank Problem

```
clc;
odeopts = odeset('RelTol', 1e-9)
spacing = 0.1;    % this is the frequency of reporting, not stepsize
tfinal = 15;
[t, h] = ode45(@exam3_tank, [0:spacing:tfinal],0, odeopts);
plot(t,h)
ylabel('liquid height')
xlabel('time')


odeopts =
               AbsTol: []
                  BDF: []
               Events: []
          InitialStep: []
             Jacobian: []
            JConstant: []
             JPattern: []
                 Mass: []
         MassConstant: []
         MassSingular: []
             MaxOrder: []
              MaxStep: []
          NonNegative: []
           NormControl: []
            OutputFcn: []
            OutputSel: []
               Refine: []
               RelTol: 1.0000e-009
                Stats: []
           Vectorized: []
      MStateDependence: []
            MvPattern: []
          InitialSlope: []
```
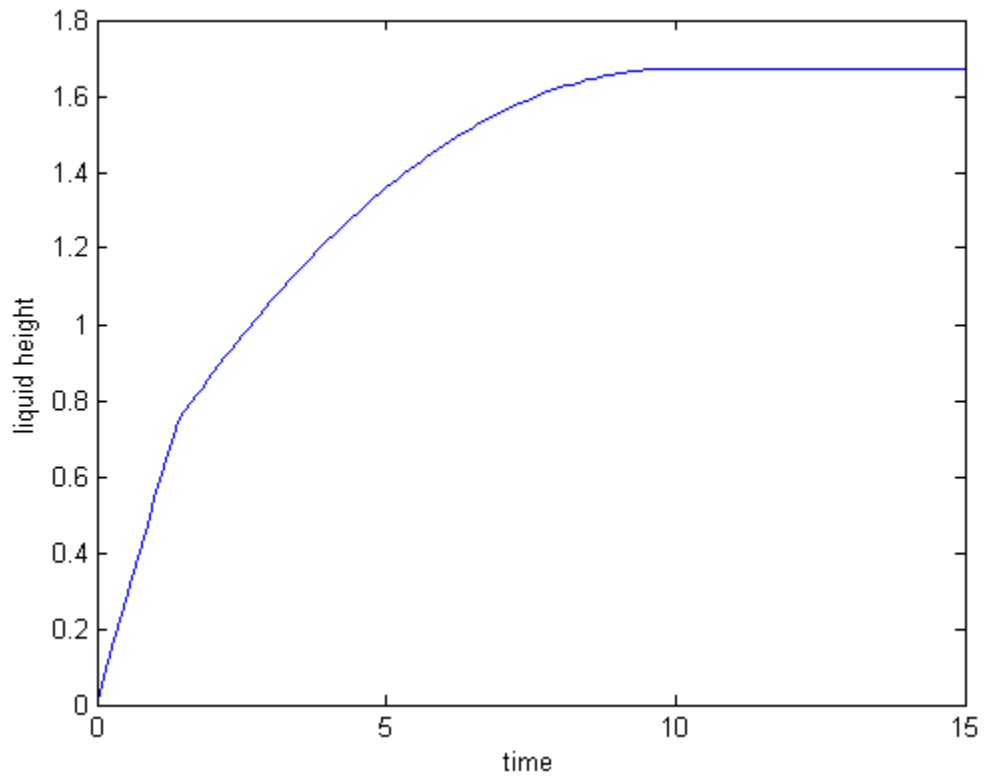
External Functions Referenced

```
%{
function dhdt = exam3_tank( t, h )
%   SOLUTION : Exam 3 Single Tank Problem
xTank=2;
xCube=1.5;
aTank=xTank^2;
aCube=xCube^2;
hTank=3;
if t > 10
    qin=0;
else
    if h >=hTank ; qin = 0; else qin = 1-0.1*t; end
end
if h<0.5*xCube; A=aTank-aCube; else A=aTank; end
dhdt = qin/A;
end
%}
%{
function [ x, y ] = make_circle(r, xcenter, ycenter)
theta = [0:0.01*pi:2*pi];
x = xcenter+r.*cos(theta);
y = ycenter+r.*sin(theta);
end
%}
```

Published with MATLAB® 7.10