**Exam 1 Answers, CSC 2262, Spring 2017**

**Problem 1 Answer**

**Max Points: 25**

**d = 650;**

**h = 560;**

**x = 1700;**

**g = 9.81;**

**for(v0 = 180:5:190)**

**f=@(theta) v0\*cos(theta)/g \* ( v0\*sin(theta) + ...**

**sqrt(v0^2\*sin(theta)^2-2\*g\*h) ) – d - x;**

**stepsize = 1\*pi/180;**

**for(grid\_point = 30:stepsize:90\*pi/180)**

**left\_end\_point = grid\_point;**

**right\_end\_point = grid\_point + stepsize;**

**function\_left = f(left\_end\_point);**

**function\_right = f(right\_end\_point);**

**if(function\_left\*function\_right < 0 || function\_right == 0)**

**guess = (left\_end\_point + right\_end\_point)/2;**

**theta = fzero(f, guess);**

**y = d\*tan(theta) - g\*d^2/(2\*v0^2\*cos(theta)^2);**

**ymax = v0^2\*sin(theta)^2/(2\*g);**

**fprintf('v0=%d theta=%.5f y=%.5f ymax=%.5f\n', ...**

**v0,theta\*180/pi,y,ymax);**

**end**

**end**

**fprintf(‘\n’);**

**end**

**Problem 2 Answer**

**Max Points: 16**

**R1 = 4.15;**

**R2 = 2.56;**

**R3 = 3.24;**

**R4 = 3.78;**

**guess1 = 30\*pi/180;**

**guess2 = 75\*pi/180;**

**accuracy = 1e-7;**

**for(t2 = 84\*pi/180 : 1\*pi/180 : 804\*pi/180)**

**f1 = @(t3,t4) R2\*cos(t2) + R3\*cos(t3) + R4\*cos(t4) - R1;**

**f2 = @(t3,t4) R2\*sin(t2) + R3\*sin(t3) - R4\*sin(t4);**

**df1d1=@(t3,t4) –R3\*sin(t3);**

**df1d2=@(t3,t4) –R4\*sin(t4);**

**df2d1=@(t3,t4) R3\*cos(t3);**

**df2d2=@(t3,t4) –R4\*cos(t4);**

**[t3 t4]=newton2(f1,f2,df1d1,df1d2,df2d1,df2d2,guess1,guess2,accuracy);**

**end**

**Problem 3 Answer**

**Max Points: 18**

**line1x = [ 0 R1 ];**

**line1y = [ 0 0 ];**

**line2x = [ 0 R2\*cos(t2) ];**

**line2y = [ 0 R2\*sin(t2) ];**

**line3x = [ R2\*cos(t2) R2\*cos(t2)+R3\*cos(t3) ];**

**line3y = [ R2\*sin(t2) R4\*sin(t4) ];**

**% line3y=[ R2\*sin(t2) R2\*sin(t2)+R3\*sin(t3) ]; is also correct**

**line4x = [ R2\*cos(t2)+R3\*cos(t3) R1 ];**

**line4y = [ R4\*sin(t4) 0 ];**

**% line4y=[ R2\*sin(t2)+R3\*sin(t3) 0 ]; is also correct**

**plot(line1x,line1y,'k',line2x,line2y,'r',line3x,line3y,'g', ...**

**line4x,line4y,'b');**

**Problem 4 Answer**

**Max Points: 20**

**guess1 = 2;**

**guess2 = 1.5;**

**guess3 = 1;**

**accuracy = 1e-7;**

**f1 = @(x,y,z) x\*y - z^2 - 1;**

**f2 = @(x,y,z) x\*y\*z + y^2 - x^2 - 2;**

**f3 = @(x,y,z) exp(x) + z - exp(y) - 3;**

**df1d1 = @(x,y,z) y;**

**df1d2 = @(x,y,z) x;**

**df1d3 = @(x,y,z) -2\*z;**

**df2d1 = @(x,y,z) y\*z - 2\*x;**

**df2d2 = @(x,y,z) x\*z + 2\*y;**

**df2d3 = @(x,y,z) x\*y;**

**df3d1 = @(x,y,z) exp(x);**

**df3d2 = @(x,y,z) -exp(y);**

**df3d3 = @(x,y,z) 1;**

**[x y z] = newton3(f1,f2,f3,df1d1,df1d2,df1d3,df2d1,df2d2,df2d3, ...**

**df3d1,df3d2,df3d3,guess1,guess2,guess3,accuracy);**

**fprintf('x=%.5f y=%.5f z=%.5f\n',x,y,z);**

**Problem 5 Answer**

**Max Points: 19**

**t = 0:.001:30;**

**u0 = [800 400 500 300];**

**options = odeset('AbsTol',1e-7,'RelTol',1e-7);**

**[t u] = ode45('prog5f',t,u0,options);**

**plot(t,u(:,1),'r',t,u(:,2),'b',t,u(:,3),'g',t,u(:,4),'m');**

**function f = prog5f(t,uf)**

**A = .004;**

**B = .03;**

**C = .0017;**

**D = .0012;**

**E = .0038;**

**F = .00076;**

**G = .00045;**

**x = uf(1);**

**y = uf(2);**

**z = uf(3);**

**w = uf(4);**

**f = zeros(4,1);**

**f(1) = x - x^2 - B\*x\*y;**

**f(2) = -y\*z - A\*y + D\*x\*y;**

**f(3) = y\*z - C\*z;**

**f(4) = -w^2 - E\*w + F\*w\*y\*z + G\*w\*x\*y;**

**Problem 6 Answer**

**Max Points: 34**

**t = 0:.001:6;**

**u0 = [.6 0 .3 0 .5 0 .7 0 .4 0];**

**options = odeset('AbsTol',1e-7,'RelTol',1e-7);**

**[t u] = ode45('prog6f',t,u0,options);**

**line1x = [0 6];**

**line1y = [0 0];**

**figure(1);**

**plot(t,u(:,1),'m',t,u(:,3),'g',t,u(:,5),'b',t,u(:,7),'c', ...**

**t,u(:,9),'r',line1x,line1y,'k');**

**figure(2);**

**plot(t,u(:,2),'m',t,u(:,4),'g',t,u(:,6),'b',t,u(:,8),'c', ...**

**t,u(:,10),'r',line1x,line1y,'k');**

**function f = prog6f(t,uf)**

**m1 = .9;**

**m2 = .5;**

**m3 = .8;**

**m4 = .4;**

**m5 = .6;**

**k1 = 4.4;**

**k2 = 5.3;**

**k3 = 4.1;**

**k4 = 5.5;**

**k5 = 4.7;**

**k6 = 5.6;**

**x1 = uf(1);**

**v1 = uf(2);**

**x2 = uf(3);**

**v2 = uf(4);**

**x3 = uf(5);**

**v3 = uf(6);**

**x4 = uf(7);**

**v4 = uf(8);**

**x5 = uf(9);**

**v5 = uf(10);**

**f = zeros(10,1);**

**f(1) = v1;**

**f(2) = 1/m1\*( -k1\*x1 + k2\*(x2-x1) );**

**f(3) = v2;**

**f(4) = 1/m2\*( -k2\*(x2-x1) + k3\*(x3-x2) );**

**f(5) = v3;**

**f(6) = 1/m3\*( -k3\*(x3-x2) + k4\*(x4-x3) );**

**f(7) = v4;**

**f(8) = 1/m4\*( -k4\*(x4-x3) + k5\*(x5-x4) );**

**f(9) = v5;**

**f(10)= 1/m5\*( -k5\*(x5-x4) – k6\*x5 );**