Name: Date: Class:

Code (Day 3 – Step 4)

This code was designed for simulating the movement of a volleyball ball on the Earth. However, it could be done some changes to teach the students how a code works and what are the effects when some variables change.

1. Copy and paste the following entire code into octave-online.net
2. Ask the students to modify the numbers (highlighted in yellow) to understand how the serving speed, serve angle, and player height could influence in the ball trajectory on the Earth.
3. Now, ask to change the gravity value (highlighted in green) from 32.2 ft/s^2 to 5.37 ft/s^2 (gravity on the Moon). Let them to explore with the other variables to see what happens.

```
%%%

%these are the variables you need to edit

gravity = 32.2; %feet per second squared

serving_speed = 45; %feet per second

serve_angle = 20; %degrees

player_height = 6; %feet

court_length = 60; %feet

net_height = 7; %feet
%%%

initial_velocity_x = serving_speed * cosd(serve_angle);
initial_velocity_y = serving_speed * sind(serve_angle);


%final_velocity_x = initial_velocity_x;
final_velocity_y = -sqrt(initial_velocity_y ^ 2 + 2 * gravity * player_height);

travel_time = (final_velocity_y - initial_velocity_y) / -gravity;

%x = ones(1, 61);
%y = x;
v = zeros(1, 61);

v(1) = initial_velocity_y;
x(1) = 0;
y(1) = player_height;

t = linspace(0, travel_time, 61);
```

```
dt = t(2) - t(1);
%z = 1;

%yline(net_height, 'LineWidth',5); %horizontal line, net
hold on;
%xline(court_length, 'LineWidth',5); %vertical line, back boundry line
%yline(0, 'LineWidth',5); %horizontal line, floor
%plot(60, 0, 'rx', 'MarkerSize',10);
plot(30, net_height, 'rx', 'MarkerSize',30);
plot([30 30], [0 net_height], 'LineWidth',5) %net

for i = 2:61

    %v(i) = v(i-1) -  gravity * dt;
    v(i) = v(1) - gravity * t(i);

    x(i) = x(i-1) + initial_velocity_x * dt;

    %y(i) = y(i-1) + v(i) * dt - 1/2 * gravity * dt ^ 2;
    y(i) = y(i-1) + v(i-1) * dt - 1/2 * gravity * dt ^ 2;

  % plot(x, y, 'LineWidth',5)

    if y(i) < 0 && i <= 60
        %z = 0; %ball hit the ground in bounds
        y(30) = 0;
        y(60) = 0;
        break;
    end
end

plot(x, y, 'LineWidth',5)

% for j = 1:length(x)
%     if x(j) == 30
%         break;
%     end
% end

%j = find(x == 30);

%xnew = round(x, 4);
xnew = x;
sub_x = abs(xnew-30);
j = find(sub_x == min(sub_x));

sub_x2 = abs(xnew-60);
k = find(sub_x == min(sub_x2));

hold on;
```

```
fprintf('Parameters: \n Player Height: %d ft \n Gravity: %.2f ft/s \n Serving Speed: %d ft/s \n
Serving Angle: %d degrees \n Net Height: %d ft \n Court Length: %d ft \n\n', player_height,
gravity, serving_speed, serve_angle, net_height, court_length);

if serve_angle == 90 || serve_angle == 270 || y(j) <= net_height
   fprintf('\nThe ball WILL NOT clear the net.\n\n');

else
     fprintf('\nThe ball will clear the net.\n\n');

   %if y(k) > 0
   if x(i) > court_length
      fprintf('The ball will land out of bounds (%.2f feet).\n\n', x(i));
   else
       fprintf('The ball will land in bounds (%.2f feet).\n\n', x(i));
   end
end
```