HW 14   10 points.

Problem 1

   You are the team coordinator for the city bowling league planning for the league playoffs. There are 12 teams on the league numbered 1 to 12. The first round of playoffs will be on Monday through Saturday. You are to write a MATLAB program that will randomly pair the teams using their team numbers and assign which day of the week will be their games. The output should have a nice looking form using fprintf. All teams play in the playoffs and no team plays twice. There are 6 games total.

   Hint: see the randperm(n) command in your book.

Problem 2

   You are planning to collect rainwater for the local community gardens.   You have been donated a large tank of about 2.0 m radius. Your challenge is to determine the minimum height the tank must be so that it will not overflow. Taking some measurements, you have found that the rain water collection area reaches a maximum flow of 0.14 m^3 /s. Your tank design has an outlet hole at the bottom of the tank of area 0.023 m^2.

acceleration due to gravity = 9.8 m/s^2

height of the water = h

water flow into the tank is 0.14 m^3/s

h   The outlet area = A_{outlet} = 0.023 m^2
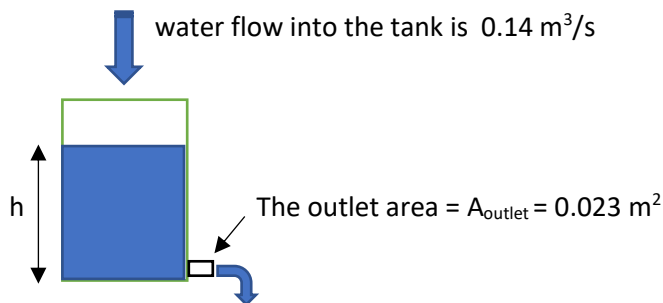
Water volume flow out of the outlet is Q in m^3/s. See the formula for Q below.

Model the problem as 0.14 m^3 of water is flowing into the tank every second. The water flows out faster as the water depth gets deeper but every second the flow out of the water, Q, is:

$$Q = A_{outlet}(\sqrt{2gh})$$

Since the volume of the water in the tank = $\pi r^2 h$ calculate the height of the water at any time:

$$h = (WaterInTank)/(\pi(2.0)^2).$$

It takes about 3000 seconds to reach the maximum height in the tank. Create a loop in which every second 0.14 m^3 of water flows in and water flows out based on the height of the water. Don't forget water is accumulating in the tank.

Problem Logic:

The initial conditions are h = 0 and WaterInTank= 0

Create a loop so that each pass of the loop is 1 second

Inside the loop:

WaterInTank= WaterInTank+ FlowIn– Q;

Update the value of h every time through the loop. See the formula on the previous page.

Since Q (the flow out) changes with the height of the water you must calculate Q every pass through the loop.   FlowIn is constant at 0.14 m^3/s.

Save the Water Height values (h) in an array inside the loop.

Your problem should contain in the output:

   A. Make a graph of Water Height vs. Time.
   B. Make an fprintf statement that says the minimum tank height to 2 decimal places. The minimum tank height is equal to the maximum value of h.   **BE SURE TO SUPPRESS YOUR OUTPUT!!** With a loop of 3000 iterations it will take hundreds of pages of paper or pages on a screen to print this if you do not suppress your calculations in the output!!!