HW02 Hints

1. (Exercise plan) As part of your New Year's resolution, you came up with the following exercise plan:

   - Monday through Friday: light 1-mile jog
   - Saturday: 3-mile run
     - except for every 4th Saturday on which you go for 5-mile run;
     - except for every 12th Saturday on which you rest to avoid overtraining.
   - Sunday: rest

   Write an app (i.e., a MATLAB script) which tells you what to do given a day of the year.

   Note. For simplicity:
   - Denote days of the year using an integer between 1 and 365 (no leap year).
   - The first day of the year is Monday.

2. (Angle finder) Re-do Exercise 3 in Lecture 3, now for $\theta \in [0, 2\pi)$. Write two versions, one using `atan` and the other using `atan2`.

3. (Guess-the-number) Write the following game in which a user is to guess the integer randomly generated by the computer. In the program:

   - User inputs the lower and the upper bounds of the range.
   - The program generates a random integer within the specified range and stores it in a variable.
   - Use a `while`-loop for repeated guessing.
     - If the user guessed a number larger than the generated number, print out "Your guess is too high. Try again!".
     - If the user guessed a number smaller than the generated number, print out "Your guess is too low. Try again!".
     - If the user guessed the number correctly, print out "Congratulations!" and terminate the program.

   Below is an example run of the program.

```
>> guess
   Enter the lower bound: 1
   Enter the upper bound: 100
   Guess a number: 50
   Your guess is too low. Try again!
```

```
Guess a number: 75
Your guess is too low. Try again!
Guess a number: 87
Your guess is too high. Try again!
Guess a number: 81
Your guess is too low. Try again!
Guess a number: 84
Your guess is too high. Try again!
Guess a number: 82
Congratulations!
```

4. (Biased dice) Simulate the rolling of a *biased* dice whose probability profile is given by

number	1	2	3	4	5	6
probability	1/12	1/6	1/4	1/4	1/6	1/12

   Then simulate the rolling of two such dice until the sum is 7. Print out the number of rolls needed. Then use a for-loop to repeat the simulation 10 times.

5. (Approximating π) For large n,

$$R_n = 1 - \frac{1}{3} + \cdots - \frac{(-1)^{n+1}}{2n-1} = \sum_{k=1}^{n} \frac{(-1)^{k+1}}{2k-1} \approx \frac{\pi}{4}$$
$$T_n = 1 + \frac{1}{2^2} + \cdots + \frac{1}{n^2} = \sum_{k=1}^{n} \frac{1}{k^2} \approx \frac{\pi^2}{6}$$
$$U_n = 1 + \frac{1}{2^4} + \cdots + \frac{1}{n^4} = \sum_{k=1}^{n} \frac{1}{k^4} \approx \frac{\pi^4}{90},$$

   giving three different ways to estimate π:

$$\rho_n = 4R_n$$
$$\tau_n = \sqrt{6T_n}$$
$$\mu_n = \sqrt[4]{90U_n}.$$

   Write a script that displays the value of $|\pi - \rho_n|$, $|\pi - \tau_n|$, and $|\pi - \mu_n|$ for $n = 100, 200, 300, \ldots, 1000$.