

## CAD Applications (2)

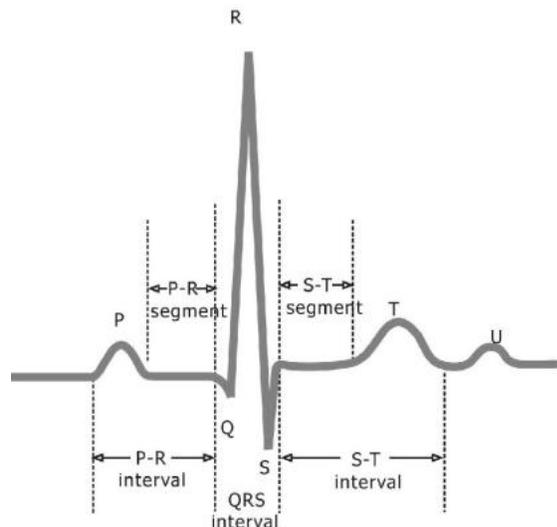
### Part (1)

### M-Files Programing

1. Write a Matlab script that detects the average heart rate per minute (beats per minute - BPM) extracted from the electro-cardiogram (ECG) signal given in the attached file (ecg.txt). The attached ECG samples were captured in 100 Hz rate (i.e. 100 samples per second).

Hints:

- You can use “load” function to import data from a file.
- Plot the original ECG signal (try to zoom to get understand the actual figure).
- Process the loaded signal to extract the periodic peaks and count the number of peaks per minute.



2. Using the three attached audio files(bass.wav, drum.wav, guitar.wav), perform the following audio signal processing steps in Matlab:
  - a) Load the 3 files into matlab vectors using “wavread” built-in function.
  - b) What is the recording time of each signal assuming a CD sound quality of 44100 samples/sec.
  - c) Create a new vectors containing only 10 seconds segments of the original files (from 10:20 seconds)
  - d) Use the “sound” built-in function to run the 3 new segments sounds.
  - e) Create a composite piece of music by combining the 3 segments together with equal amplitudes.
  - f) Create a composite piece of music by combining the 3 segments together with equal different amplitudes.
  - g) How to create a composite signal where one of the component gradually increasing its amplitude
  - h) Create a Stereo audio for the three segments by creating a 2 column vector (2 channels) with different amplitude for each segment. Combine the new 3 signals and play it using sound.

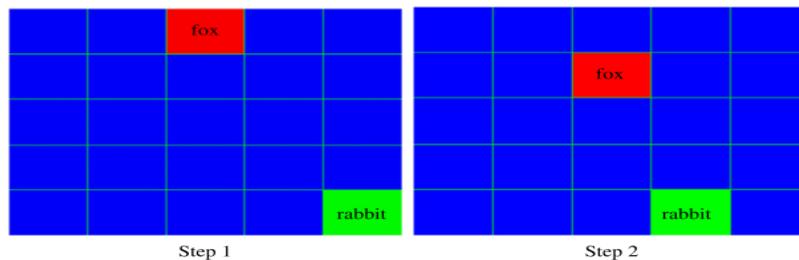
### 3. Project: The Fox and Rabbit Game

Hint: Check chapter 9, page 321 in Matlab reference (Matlab By Examples) for a complete description of the project and sample graphic code.

The fox and rabbit game is a zero-player game. It is played on a 5 x 5 grid of square cells. This grid represents a jungle and is shown in the following figure. The game contains one rabbit, which is represented by a green cell, and one fox, which is represented by a red cell.

The game is played as follows:

1. Place the rabbit in a random location on the grid.
2. Place the fox in a random location on the grid.
3. The game involves only five steps.
4. In each step:
  - a) Move the rabbit one step randomly in one of the eight different directions.
  - b) Move the fox one step randomly in one of the eight different directions.
  - c) If the fox and rabbit cells become neighbors, the fox eats the rabbit. The fox wins and the game terminates.
5. If the number of steps reaches five and the rabbit survives during these five steps, the rabbit wins and the game terminates.
6. The borders of the grid are wrapped. This is explained in Ch. 7, Project (2).



The following requirements for programming your game must be met:

1. Use two structures to represent the fox and the rabbit.
2. Your program should produce the following outputs:
  - a. The number of steps.
  - b. Who won the game?
  - c. A figure to show each step of the game.

**Best Regards**

**Dr. Basem ElHalawany**