# 15-112 Fundamentals of Programming

Lecture 10

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# Announcements

- Homework 3 due Tuesday 10:00pm

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# What are we doing today?

- Lists and functions
- Working with Images

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# Representing Data using lists

- We can use lists to represent 1-D data.
  - Grades of all students in Quiz1
- How about 2-D data using a list?
  - Grades of all students in all quizzes.

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# Tic-Tac-Toe

- Suppose we have a list that represents a tic-tac-toe board.
  - How big should be the list?
  - How should we initialize it?

| | | |
|---|---|---|
| 1 | 2 | 3 |
| 4 | 5 | 6 |
| 7 | 8 | 9 |

[1,2,3,4,5,6,7,8,9]

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# Printing the board

- How do we print this list so it looks like a board?

| | | |
|---|---|---|
| 1 | 2 | 3 |
| 4 | 5 | 6 |
| 7 | 8 | 9 |

[1,2,3,4,5,6,7,8,9]

- printBoard(mylist)?

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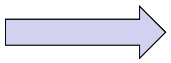
# Accessing an element

- How do I get an element at row 0, column 2

| | | |
|---|---|---|
| 1 | 2 | 3 |
| 4 | 5 | 6 |
| 7 | 8 | 9 |



[1,2,3,4,5,6,7,8,9]

- getElement(board,row,column)?

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# Setting an element

- How do I set an element at row 0, column 2

| | | |
|---|---|---|
| 1 | 2 | 3 |
| 4 | 5 | 6 |
| 7 | 8 | 9 |

[1,2,3,4,5,6,7,8,9]

- setElement(board,row,column,player)?

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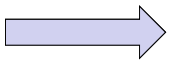
# Winning

- How do we know if a player won?

| | | |
|---|---|---|
| 1 | 2 | 3 |
| 4 | 5 | 6 |
| 7 | 8 | 9 |



[1,2,3,4,5,6,7,8,9]

- gameWon(board,player)?

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# 2-D lists

- We have seen lists that hold integers, booleans, strings, etc.
- Can lists also hold other lists?
  - [[1,2,3],[4,5,6],[7,8,9]]
    - How many elements in the above list?
  - [1,2,[7,'a',True],5,8]
    - How many elements in this list?

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# Accessing Elements in 2-D lists

```
a = [[1,2,3],[4,5,6],[7,8,9]]
```

- Reading values

```
print a[0][1]
```

- Writing values

```
a[1][0] = 12
print a
[[1,2,3],[12,5,6],[7,8,9]]
```

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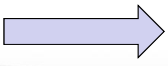
# Tic-Tac-Toe with 2-D lists

- Suppose we use a 2D-list to represent a tic-tac-toe board.
  - How big should be the list?
  - How should we initialize it?

| | | |
|---|---|---|
| 1 | 2 | 3 |
| 4 | 5 | 6 |
| 7 | 8 | 9 |



[[1,2,3],[4,5,6],[7,8,9]]

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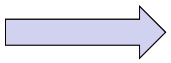
# Accessing an element

- How do I get an element at row 0, column 2

| | | |
|---|---|---|
| 1 | 2 | 3 |
| 4 | 5 | 6 |
| 7 | 8 | 9 |



[[1,2,3],[4,5,6],[7,8,9]]

- getElement(board,row,column)?

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# Setting an element

- How do I get an element at row 0, column 2

| | | |
|---|---|---|
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[[1,2,3],[4,5,6],[7,8,9]]

- setElement(board,row,column,player)?

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# Moving on to Image Processing

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# Pixels in an image

- Images or pictures are made up of small pixels.

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# Pixel Color

- Color of each pixel can be represented as a list of three values

  [ red, green, blue]

  - Each value is between 0 and 255
  - red represents amount of red in color
  - green represents amount of green in color
  - blue represents amount of blue in color

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# Determining Colors

- Some examples of colors
  - [200,0,0]
  - [0,200,0]
  - [0,0,250]
  - [50,50,50]

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# Working with images

- ImageWriter library gives you basic functions to work with images
- Download the library from the course website (Under Resources)

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# Working with Images - Example

```
import ImageWriter
mypic = ImageWriter.loadPicture("apple.gif")
ImageWriter.showPicture(mypic)
w = ImageWriter.getWidth(mypic)
for i in range(0,w):
    ImageWriter.setColor(mypic,i,40,[50,5,200])
ImageWriter.updatePicture(mypic)
ImageWriter.savePicture(mypic,"sav.jpg")
```

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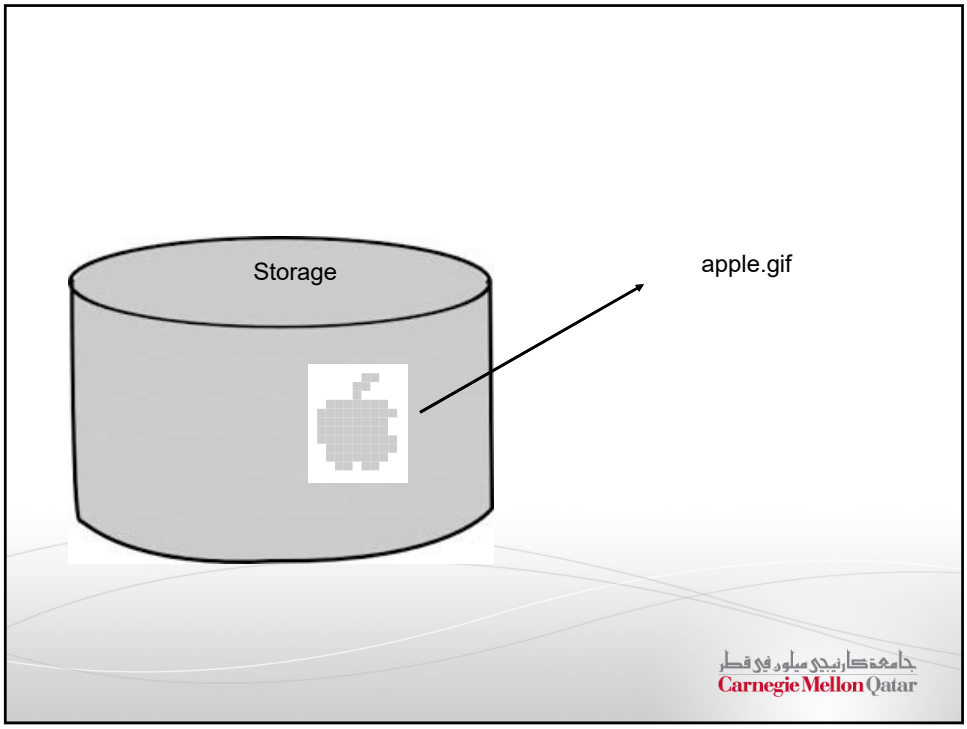
Storage
apple.gif
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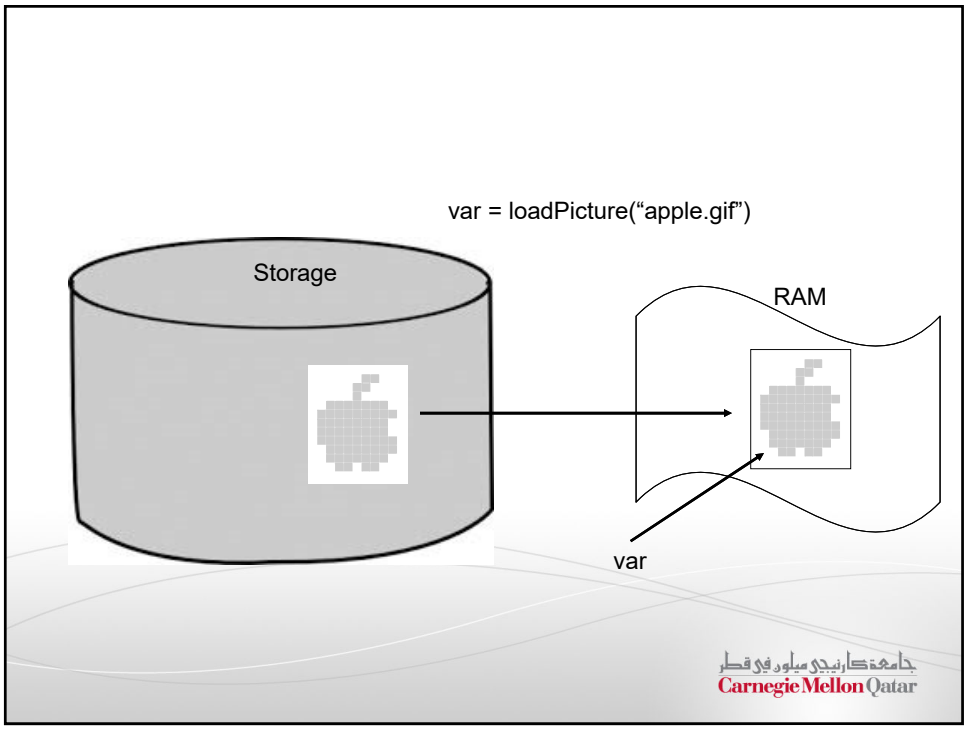
var = loadPicture("apple.gif")
Storage
RAM
var
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showPicture(var)

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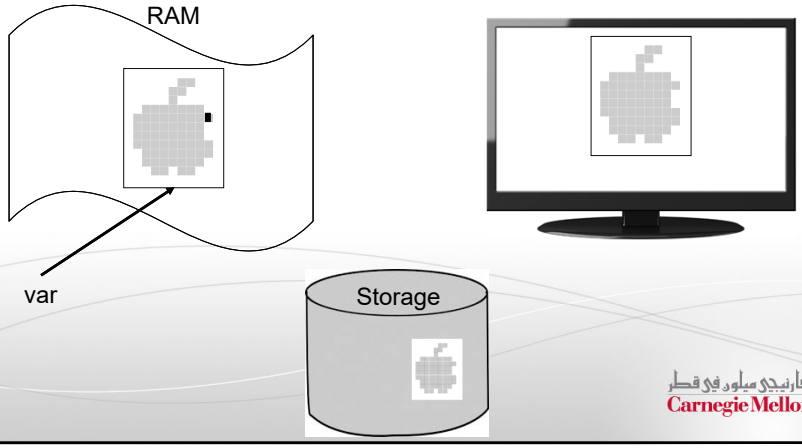
setColor(var , 5 , 9 , [0,0,0])

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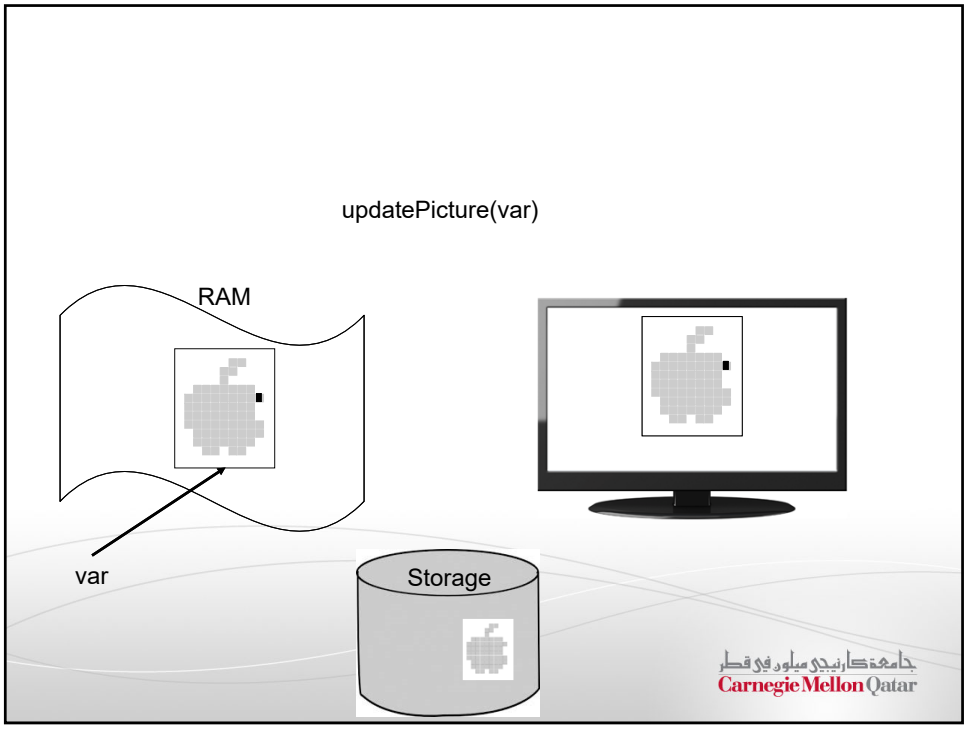
updatePicture(var)
RAM
var
Storage
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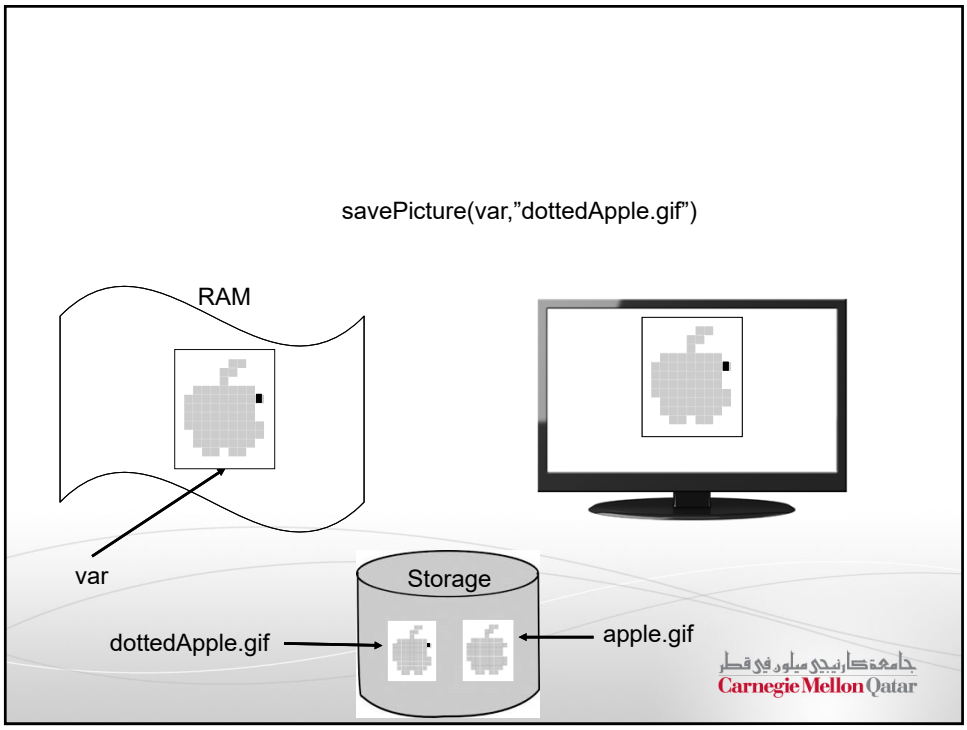
savePicture(var,"dottedApple.gif")
RAM
var
Storage
dottedApple.gif
apple.gif
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# Some Interesting Questions

How do you make an Image gray scale?

How do you make an Image Black and White?

How do you remove all reds from your image?

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