

TINKER ACADEMY

SCRATCH Computer Programming Adventure (Advanced)

Handout 6: Applications of Data Structures

Note your Student ID. You will need to use it throughout the Course.

Setup Instructions In Classroom

Connect to the Local Class Network

1. Select WiFi “TINKER ACADEMY”
2. This network has only LOCAL access and does NOT connect to the internet

Update the Course

1. Ensure you are connected to “TINKER ACADEMY”
2. Restart the VM. Login into the VM.
3. Open Firefox in the VM
4. Your Instructor would tell you what to type in the browser. (Typically it is 192.168.1.5)
5. You should see a page with a list of entries.
6. Click on CourseUpdate<Date>.zip. This will download CourseUpdate<Date>.zip onto your VM
7. Open Nautilus. Click on Downloads. You should see the file CourseUpdate<Date>.zip
8. Right Click on CourseUpdate<Date>.zip. Select Extract Here.
9. Open the extracted folder
10. Double click Course Update. Select “Run” in the window.

Update the Course (Alternate Approach In Class Using USB)

1. Borrow a USB drive from the Instructor
2. If you are on VirtualBox
 - a. Click on Devices in the Top level Menu
 - b. Select Drag ‘n’ Drop
 - c. Select Bidirectional
3. If you are on VirtualBox (Another Way)
 - a. Shutdown Virtual Machine
 - b. Click on VM in the VirtualBox Manager
 - c. Click on the Settings
 - d. Click General
 - e. Click Advanced Tab

- f. Select "Bidirectional" under Drag 'n' Drop
 - g. Click OK
 - h. Start Virtual Machine
4. If you are on VMWare
 - a. Open the virtual machine settings editor (VM > Settings),
 - b. Click the Options tab
 - c. Select Guest isolation.
 - d. Deselect Disable drag and drop to and from this virtual machine
5. Open Nautilus, Click on Desktop
6. Drag the file **CourseUpdate<Date>.zip from Windows or Mac** onto Desktop in your Virtual Machine
7. Right Click on **CourseUpdate<Date>.zip**. Select Extract Here.
8. Open the extracted folder
9. Double click **Course Update**. Select "Run" in the window.
10. Eject the USB Drive and hand it back to the Tinker Academy instructor

Setup Instructions At Home

Connect to your Home WiFi Network

Updating the Course (Using Wifi)

1. Make sure you are on the Home WiFi Network.
2. Click the "Setup" folder in "Nautilus" under "Bookmarks"
3. Double click "Course Update". Choose "Run".
If you see a window popup with the message "update course failed".
Hop onto Skype, and request help in the class chat group.
And send an email to classes@tinkeracademy.com with your name and student ID.
4. Follow the instructions in this handout (last 2 pages) on the quiz and homework steps.

Submitting Quiz and Homework

1. Make sure you are on the Home WiFi Network.
2. Click the "Setup" folder in "Nautilus" under "Bookmarks"
3. Double click "Course Submit". Choose "Run".
If you see a window popup with the message "submit course failed".
Hop onto Skype, and request help in the class chat group.
And send an email to classes@tinkeracademy.com with your name and student ID.

Virtual Machine Installation

Installing the Virtual Machine (VM)

1. Borrow the USB drive from your Tinker Academy instructor
2. Create the folder “tinkeracademy” (without the quotes) under Documents using Finder or Windows Explorer. Type it in *exactly* as indicated.
3. Copy the folder “installers” from the USB drive to under “tinkeracademy” using Finder or Windows Explorer
4. Eject the USB Drive and hand it back to the Tinker Academy instructor
5. Locate the VirtualBox installer under “tinkeracademy” using Finder or Windows Explorer

| If your Laptop is | Double click on |
|-------------------|---------------------------------|
| Windows 7 | VirtualBox-4.3.12-93733-Win.exe |
| Windows 8 | VirtualBox-4.3.14-95030-Win.exe |
| Mac | VirtualBox-4.2.26-95022-OSX.dmg |

6. Install the VirtualBox application
7. Congratulations, You completed a major milestone. Give yourself a pat on the back :)

Importing the Virtual Machine (VM)

1. Locate the Virtual Machine “tinkeracademy.ova” under “tinkeracademy”
2. Double click on “tinkeracademy.ova”. You should get the import screen in VirtualBox with an “Import” Button. Click on the “Import” button to Import the Virtual Machine.

Starting the Virtual Machine (VM)

1. Once the Import is complete and successful, you should see the VM “TinkerAcademy” in the side panel in VirtualBox.
2. If it says “Powered Off” click on the Start Button (Green Arrow) in the VirtualBox Toolbar. This will start the VM.
3. If it says “Running” click on the Show Button (Green Arrow) in the VirtualBox Toolbar. This should display the VM window.
4. Once the VM starts up you will be presented with a login screen. Type in “password” without the quotes. Type it in exactly as indicated and hit “Enter”.
5. Once the login is completed you should see a Desktop with a few icons. The Screen might go fuzzy for a few seconds before displaying the Desktop. *That is ok.*
6. Congratulations. You are now running Linux within your laptop.
7. Double click on the “Firefox” icon in the Sidebar. This should launch Firefox. Verify you have network access. Close “Firefox”

Launching the Virtual Machine in Full Screen

1. Use the VirtualBox menu View->Switch to Fullscreen to switch the VM to fullscreen mode
2. Use the same VirtualBox menu View->Switch to Fullscreen to switch the VM back out of fullscreen mode

Shutting Down the Virtual Machine

1. Click on the red close window button (to the top left on a Mac, top right in Windows).
2. You will be prompted with a confirmation message asking if you want to "Power Off" the machine. Click the button to confirm power off.
3. In a few minutes the VM will shut down and you should see the VirtualBox side panel with the "Tinker academy" VM indicating "Powered Off".

Restarting the Virtual Machine

1. Start VirtualBox
2. Click on the VM "TinkerAcademy" in the VirtualBox side panel.
3. Click on the Start Button (Green Arrow) in the VirtualBox Toolbar. This will start the VM.
4. Once the VM startup you will be presented with a login screen.

Right Click in VM on Mac

1. Open System Preferences, Trackpad
2. Enable "Secondary Click", Toggle the small arrow to the right and select "Click with two fingers".

Getting Ready to Program

Open StarterPack7.sb2

We will use StarterPack7.sb2 **updated from previous class** to begin to implement Tic Tac Toe using data structures

1. Click the “Courses” folder under “Bookmarks”. Navigate to the TA-SCR-2 and locate the Scratch program “StarterPack7.sb2” under “starterpack4”.
2. Select the file. Right click and select “Open With Scratch 2”. This will open the Scratch Program StarterPack7.sb2 in the Scratch GUI.

Structure of StarterPack7.sb

The Scratch Program in StarterPack7.sb has

1. A Stage with the Tic Tac Toe backdrop
2. Sprites named “Marker 1” to Marker 9 for the “Tic Tac Toe” markers

What will our Program do?

In our program, we will represent the 2D matrix of Tic Tac Toe using a list data structure. We will then implement Tic Tac Toe for 2 players.

Refresher

| Variable | Description | Possible Value |
|---------------|--|----------------|
| TRUE | Marker variable indicating the Boolean value TRUE | 1 |
| FALSE | Marker variable indicating the Boolean value FALSE | 2 |
| CLICK_ROW_NUM | Variable indicating which row was clicked | 1 to 3 |
| CLICK_COL_NUM | Variable indicating which col was clicked | 1 to 3 |

| Function | Description |
|----------|-------------|
|----------|-------------|

| | |
|---------------|---|
| IS_VALID_TURN | Sets the IS_VALID_TURN variable to either TRUE or false |
|---------------|---|

In this Handout

Update the markers to do the following

1. Listen to Marker(i) messages generated from stage click events
2. Calculate the marker location X_POSITION and Y_POSITION using the CLICK_ROW_NUM and CLICK_COL_NUM

$$X_POSITION = CLICK_COL_NUM * 160 - 160 * 2$$

$$Y_POSITION = CLICK_ROW_NUM * -120 + 120 * 2$$

3. Move marker to new X_POSITION, Y_POSITION
4. Show the Marker

The controller would need to do the following

1. Update the Marker
 - a. ~~Check the value of the TURN variable~~
 - b. ~~Identify which marker would need to be moved~~
 - c. Request the marker to move to the appropriate slot and show itself
 - d. Update the TIC_TAC_TOE list using the MAP function

| Function | Description |
|-----------------|---|
| MAP_CIRCLE_SLOT | Replace the entry in TIC_TAC_TOE at ROW_NUMBER, COL_NUMBER with the CIRCLE_SLOT |
| MAP_CROSS_SLOT | Replace the entry in TIC_TAC_TOE at ROW_NUMBER with the CROSS_SLOT |

- 2) Check if the game is completed
 - a) If the last turn created a winning combination the game is a won by the last player

| Function | Description | | | | | | | | | | | | |
|------------------|---|------------------|-------|-----------|---------------|---|------------------|---------------|---|----------|---------------|---|------------|
| IS_GAME_COMPLETE | <p>GAME_COMPLETE variable will indicate if the game is in progress, won or is a draw</p> <table><tr><th>Variable</th><th>Value</th><th>Indicates</th></tr><tr><td>GAME_COMPLETE</td><td>0</td><td>Game In Progress</td></tr><tr><td>GAME_COMPLETE</td><td>1</td><td>Game Won</td></tr><tr><td>GAME_COMPLETE</td><td>2</td><td>Game Drawn</td></tr></table> <p>Initially GAME_COMPLETE will be 0</p> <p>GAME_COMPLETE = 1 if</p> <ul style="list-style-type: none">Winning combination exists for last turn <p>GAME_COMPLETE = 2 if</p> <ul style="list-style-type: none">TURN = 8No winning combination <p>If a winning combination exists, update</p> <ul style="list-style-type: none">WIN_ROW_NUM1WIN_ROW_NUM2WIN_ROW_NUM3WIN_COL_NUM1WIN_COL_NUM2WIN_COL_NUM3 | Variable | Value | Indicates | GAME_COMPLETE | 0 | Game In Progress | GAME_COMPLETE | 1 | Game Won | GAME_COMPLETE | 2 | Game Drawn |
| Variable | Value | Indicates | | | | | | | | | | | |
| GAME_COMPLETE | 0 | Game In Progress | | | | | | | | | | | |
| GAME_COMPLETE | 1 | Game Won | | | | | | | | | | | |
| GAME_COMPLETE | 2 | Game Drawn | | | | | | | | | | | |

b) Else If no more turns are possible (all slots filled up) the game is a draw

3) Update the board

a) Draw the line through the winning combination

| Function | Description |
|---------------|---|
| DRAW_WIN_LINE | <ol style="list-style-type: none"> Clear Pen Calculate initial X_POSITION, Y_POSITION using WIN ROW and COL Move to initial X_POSITION, Y_POSITION Pen Down |

| | |
|--|---|
| | <ol style="list-style-type: none">5. Calculate next win X_POSITION, Y_POSITION6. Draw to next win X_POSITION, Y_POSITION (order is not important)7. Calculate last win X_POSITION, Y_POSITION8. Draw to next win X_POSITION, Y_POSITION (order is not important)9. Pen Up |
|--|---|

b) Let the user know of the win or draw

Quiz 7: Applications of Data Structures

Open the Quiz

Make sure you are on WiFi.

Follow the instructions in “Updating the Course” in this Handout.

Open Quiz7.odt under “Courses” “TA-SCR-2” “quiz” “quiz7”

Complete the Quiz

1. Attempt each question. Type in the answers in the “Answer:” box.
2. Save the file using File->Save or Ctrl-S

Submit the Quiz

Make sure you are on WiFi.

Follow the instructions in “Submitting Homework” in this Handout.

Homework 7: Applications of Data Structures

Overview

The Homework is a continuation of the simple drawing application.

Click on the green flag to start the application.

Click on the START button to begin the drawing mode.

Keep the mouse button pressed down and drag the mouse to draw shapes on the Stage.

Open the Homework

Make sure you are on WiFi.

Follow the instructions in “Updating the Course” in this Handout.

Open Homework7.sb2 under “Courses” “TA-SCR-2” “homework” “homework7”

Complete the Homework

We are now going to add code to support computer based game play

To get started, we are going to make simple controller changes so that the first player is a human and the second player is the computer

The Human plays the Cross Marker

The computer plays the Circle Marker.

Your changes should support the following

1. The First Player is Human and will make moves by clicking on the board slots.
2. After each move by the human player, the controller should make some move (ANY move) to move the appropriate Circle Markers into an empty slot if it exists.

Test your program. If your program does not run successfully you will not get any credit.

Submit the Homework

Make sure you are on WiFi.

Follow the instructions in “Submitting Homework” in this Handout.