TINKER ACADEMY

SCRATCH Computer Programming Adventure (Advanced)

Handout 5: Applications of Data Structures

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

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.

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 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".

Open StarterPack4.sb2
We will use StarterPack4.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 "StarterPack4.sb2" under "starterpack4".
2. Select the file. Right click and select "Open With Scratch 2". This will open the Scratch Program StarterPack4.sb2 in the Scratch GUI.

Structure of StaterPack4.sb
The Scratch Program in StarterPack4.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.

1	2	3
4	5	6
7	8	9

1	2	3	4	5	6	7	8	9

We will be using a 3 x 3 Matrix

1. Let R represent the Row (R starts from 1)
2. Let C represent the Column (C starts from 1)
3. Let I represent the List Index (I starts from 1)

$$I = (R - 1) * 3 + (C - 1) + 1$$

R	C	I
1	1	1
1	2	2
1	3	3
2	1	4
2	2	5
2	3	6
3	1	7
3	2	8
3	3	9

Mapping List Index to a Row and Column

We will be using a 3 x 3 Matrix

1. Let R represent the Row (R starts from 1)
2. Let C represent the Column (C starts from 1)
3. Let I represent the List Index (I starts from 1)

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C = (I - 1) % 3 + 1
R = (I - 1) / 3 + 1
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I	R	C
1	1	1
2	1	2
3	1	3
4	2	1
5	2	2
6	2	3
7	3	1
8	3	2
9	3	3

Additional Functions

MAP_X_Y_TO_INDEX
Map the Mouse X, Y location to a 2D List index

DRAW_CIRCLE_AT_ROW_COL
Draw a Circle at RowNum, ColNum

DRAW_CROSS_AT_ROW_COL
Draw a Cross at RowNum, ColNum

CHECK_IF_WON
Checks if a winning combination exists on the Board

Additional Variables

The TURN Variable will be used to keep track of the turn
The variable has 2 possible values

Value	Indicates
0	Cross will be drawn
1	Circle will be drawn

Additional Scripts

We will use MAP_X_Y_TO_INDEX function when the user clicks on a Tic Tac Toe slot.
The function returns a 2D List Index I
Get RowNum R from the 2D List
Get ColNum C from the 2D List

The List Index will be used to check if the slot is occupied.

If the slot is occupied then no action will be taken.
If the slot is not occupied, then
- occupy slot and invoke the DRAW_CROSS_AT_ROW_COL if TURN = 0
- occupy slot and invoke the DRAW_CIRCLE_AT_ROW_COL if TURN = 1

Quiz 5: Applications of Data Structures

Make sure you are on WiFi.
Follow the instructions in "Updating the Course" in this Handout.
Open Quiz5.odt under "Courses" "TA-SCR-2" "quiz" "quiz5"

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 5: Applications of Data Structures

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 Homework5.sb2 under "Courses" "TA-SCR-2" "homework" "homework5"

Complete the Homework

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.

Variables MOVE_TO and LINE are marker variables.
MOVE_TO indicates that the pen should be kept up when moving to the new x position and y position
LINE_TO indicates that the pen should be kept down when moving to the new x position and y position

You need to add code to the when I receive UNDO Script
The UNDO button should clear the screen and UNDO the previous user actions upto and including the last MOVE_TO
   1. Read the entries in the X_POSITIONS and Y_POSITIONS
   2. Set the Pen Color to the Background Color (Stage Color) to "erase" the previous user action

Make sure you save your program.

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.