

TINKER ACADEMY

SCRATCH Computer Programming Adventure (Advanced)

Handout 4: 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 StarterPack4.sb2

We will use StarterPack4.sb2 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.

Refresher

Understanding Lists

What is a list?

A list is an ordered collection of things.

For example, a list of favorite books is an ordered collection.

SCRATCH provides support for List Variables using the Data Palette.

Understanding Queues

What is a queue?

A queue is a list.

In addition to being a list, a queue has a specific order in which a new thing is added or removed from the queue.

New things get added to the end of the queue.

Things are removed from the front of the queue

Adding things to the queue

| Initially | Add Thing | Add Thing | Add Thing | Add Thing | Add Thing |
|-----------|-----------|-----------|-----------|-----------|-----------|
| | Thing1 | Thing1 | Thing1 | Thing1 | Thing1 |
| | | Thing2 | Thing2 | Thing2 | Thing2 |
| | | | Thing3 | Thing3 | Thing3 |
| | | | | Thing4 | Thing4 |
| | | | | | Thing5 |

Removing things from the queue

| Initially | Remove Thing | Remove Thing | Remove Thing | Remove Thing | Remove Thing |
|-----------|--------------|--------------|--------------|--------------|--------------|
| Thing1 | Thing2 | Thing3 | Thing4 | Thing5 | |
| Thing2 | Thing3 | Thing4 | Thing5 | | |
| Thing3 | Thing4 | Thing5 | | | |
| Thing4 | Thing5 | | | | |
| Thing5 | | | | | |

What is a stack?

A stack is a list.

In addition to being a list, a stack has a specific order in which a new thing is added or removed from the stack.

New things get added to the end of the stack.

Things are removed from the end of the stack

Adding things to the stack

| Initially | Add Thing | Add Thing | Add Thing | Add Thing | Add Thing |
|-----------|-----------|-----------|-----------|-----------|-----------|
| | Thing1 | Thing1 | Thing1 | Thing1 | Thing1 |
| | | Thing2 | Thing2 | Thing2 | Thing2 |
| | | | Thing3 | Thing3 | Thing3 |
| | | | | Thing4 | Thing4 |
| | | | | | Thing5 |

Removing things from the stack

| Initially | Remove Thing | Remove Thing | Remove Thing | Remove Thing | Remove Thing |
|-----------|--------------|--------------|--------------|--------------|--------------|
| Thing1 | Thing1 | Thing1 | Thing1 | Thing1 | |
| Thing2 | Thing2 | Thing2 | Thing2 | | |
| Thing3 | Thing3 | Thing3 | | | |
| Thing4 | Thing4 | | | | |
| Thing5 | | | | | |

Representing 2D Matrices using Lists

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

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

Quiz 4: Applications of Data Structures

Open the Quiz

Make sure you are on WiFi.

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

Open Quiz4.odt under “Courses” “TA-SCR-2” “quiz” “quiz4”

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 4: Applications of Data Structures

Overview

The Homework is a 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 Homework4.sb2 under “Courses” “TA-SCR-2” “homework” “homework4”

Complete the Homework

You will need to refer to this handout (Handout4) to write the script.

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 REDO Script

The REDO button should clear the screen and REDO all the user actions

1. Read the entries in the X_POSITIONS and Y_POSITIONS
2. If the entry is MOVE_TO keep the pen up and go to the location indicate by the next entry
3. If the entry is LINE_TO keep the pen down and go to the location indicate by the next entry

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.