TINKER ACADEMY

SCRATCH Computer Programming Adventure (Advanced)

Handout 3: Introduction to 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 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 StarterPac3.sb
We will use StarterPack3.sb to understand List and Stacks

1. Click the “Courses” folder under “Bookmarks”. Navigate to the TA-SCR-2 and locate the Scratch program “StarterPack3.sb2” under “starterpack3”.
2. Select the file. Right click and select “Open With Scratch 2”. This will open the Scratch Program StarterPack3.sb2 in the Scratch GUI.

Structure of StaterPack3.sb
The Scratch Program in StarterPack3.sb has

1. A Sprite named “Karel”. Karel is a Robot.
2. Sprites named “Marker 1”, “Marker 2”, “Marker 3”, “Marker 4” and “Marker 5”
3. The Stage - with a special backdrop of Karel’s city

About Karel’s City
Karel lives in a city. The Center of the City is at (0,0) of the Stage. Karel’s city has roads going east to west and south to south. The intersection of 2 roads is called a “corner”.

Markers are used to help Karel navigate the City Roads. Markers are numbered from 0 to 5. Each marker has a location using 2 numbers. The first number indicates the “x” position on the Stage, i.e. where it is along the east to west direction. The second number indicates the “y” position on the Stage, i.e. where it is along the south to north direction.

Karel is initially on Marker 0. The number on the marker indicates the order in which Karel should travel on the city roads. So first Karel should go to the marker numbered 1, the to the marker numbered 2 and so on…

Use Markers to locate the position
If you click on the marker, it will tell you its location giving its “x” position and its “y” position. Before we start to program, we are going to do is to check that our markers are working correctly. This will also let you know where the markers are on the Stage.
So click on Marker 0, Marker 1, Marker 2 and so until Marker 5. Each Marker will “tell” you its location.

What will our Program do?
In our program, Karel will initially traverse from Marker 0 to Marker 5. On reaching a Marker, Karel will pick up the Marker.

On reaching Marker 5, Karel will retrace the steps back to Marker 0. At each step, Karel will put back the marker picked up.

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					

Understanding Stacks

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					

Implementation

We will be using the List blocks in the Data Palette.

As before we will use broadcast to broadcast to Markers to show or hide.

Sensing and Broadcast Events

Overview

Add support for Karel to “hide Markers”.

We will be using the following new Blocks

Block Name	Palette	Used For
touching <Sprite2>	Sensing Palette	Check if Karel is touching a Marker
show	Looks Palette	Shows a Block
hide	Looks Palette	Hides a Block
broadcast (message)	Events Palette	Broadcast (message) to other Scripts.
when I receive (message)	Events Palette	Listens to (message). Activates the Script when it receives the message.

Remember that in Scratch, a Script cannot directly invoke another Script.

Add Scripts to Markers to show / hide the Marker.

Add when I receive (message) to Markers 1 to 5 to hide on receiving a hide message
Add when I receive (message) to Markers 1 to 5 to show on receiving a show message

Create the Function
PICKUP_MARKER

A new function PICKUP_MARKER that needs to work as follows

1. Use an IF Block to check for the condition that Karel is touching any of the Markers
2. If the Sprite is touching a Marker then broadcast a message to the the Marker to hide itself.

Modify Karel's Script

1. Add code to broadcast a message to Markers 1 to 5 to hide themselves.
2. Add v to Karel's Script

Create the Function
DROP_MARKER

Inputs
x position
y position
marker #

A new function DROP_MARKER that needs to work as follows

1. Broadcast a message to the the Marker to move to location and show itself.

Modify Karel's Script

1. Add code to broadcast a message to Markers 1 to 5 to show themselves.
2. Add DROP_MARKER to Karel's Script

Quiz 3: Introduction to Data Structures

Open the Quiz

Make sure you are on WiFi.
Follow the instructions in “Updating the Course” in this Handout.
Open Quiz2.odt under “Courses” “TA-SCR-2” “quiz” “quiz3”

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 3: Introduction to Data Structures

Overview

In this homework you will write a new Script so that Karel can pick up markers along a specified route, reverse the route and drop the markers in reverse order. Marker 0 will be at the earlier Marker 5, Marker 1 will be at the earlier Marker 2 and so on.

Open the Homework

Make sure you are on WiFi.
Follow the instructions in “Updating the Course” in this Handout.
Open Homework2.sb2 under “Courses” “TA-SCR-2” “homework” “homework3”

Complete the Homework

You will need to refer to this handout (Handout2) to write the script.

Your Script should start when the Green Flag is clicked.

When the Green Flag is clicked, “Karel” the Robot should move along the city roads to each of the markers locations, picking up the markers. On reaching Marker 5, reverse the route and drop the markers in reverse order. Marker 0 will be at the earlier Marker 5, Marker 1 will be at the earlier Marker 2 and so on.

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.