How the Session Works

Outline

- Practical on arrival
- Talk 1
  - Reflect on practical
  - Clarify concepts
- Practical exercises at your own pace
- Talk 2:
  - Further concepts
  - Overall reflection
- *Continue practical exercises at home*

Getting Started

- Log-on
- Find portable Python on L:\ drive and start IDLE
- Go to https://scratch.mit.edu/
- Find resources on teachinglondoncomputing.org
  - Exercise sheet (and notes) – ***START NOW***
  - Example programs
  - Slides

Teaching London Computing

KS3 and Beyond

Transition from Scratch to Python using Turtle Graphics

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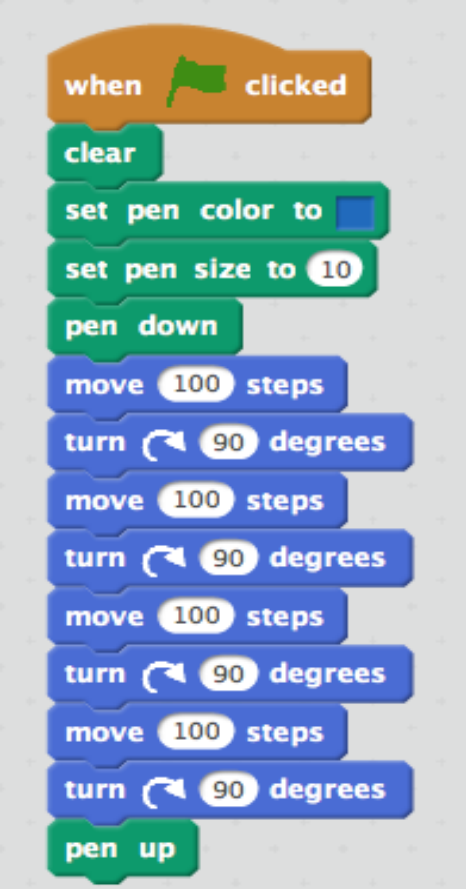
Outline

- A first turtle program in two languages
- *Discussion: barriers to textual programming*
- Learning Programming Progressively
- The turtle language
- Translating between Scratch and Python
- *Practical examples*
- Summary

First Program




```
from turtle import *

# Added code starts here
pencolor('blue')
pensize(10)

forward(100)
right(90)
forward(100)
right(90)
forward(100)
right(90)
forward(100)
right(90)
# Added code ends here

done()
```

Discussion

- *What are the challenges of learning textual programming?*

Challenges of Text Programming

- Accuracy – easy to make mistakes
- Blank sheet problem – lack of starting point
- Motivation – not visual

- Solving a problem: decomposition
- Understanding programming concepts
  - Sequence, choice, repetition, state (variables)
- Debugging

Progress in Learning Programming

- KS1 onwards
  - Computers accept commands: **algorithm**
  - … turtle often used
  - **Decomposition**: sequences, choice and repetition
- Challenges
  - Learning Scratch versus learning programming
- Core concepts
  - Problem solving and debugging
  - Programming concepts

Core Programming Concepts

- Sequence: one instruction follows another
- State: variables hold values and can change
- Choice: alternative instructions
- Repetition: repeating instructions
- Input and output

- Values (expressions) versus statements
- Abstraction: procedures / functions

Turtle Language – I

- Role of turtle in Scratch and Python
  - Turtle is a little language inside a more general language

- Essential commands
  - Forward
  - Left
  - Right
  - Pen up
  - Pen down

General language concepts
- Sequence
- Repetition (bounded)
- Function abstraction

Turtle Language – II

- Use of co-ordinates and headings

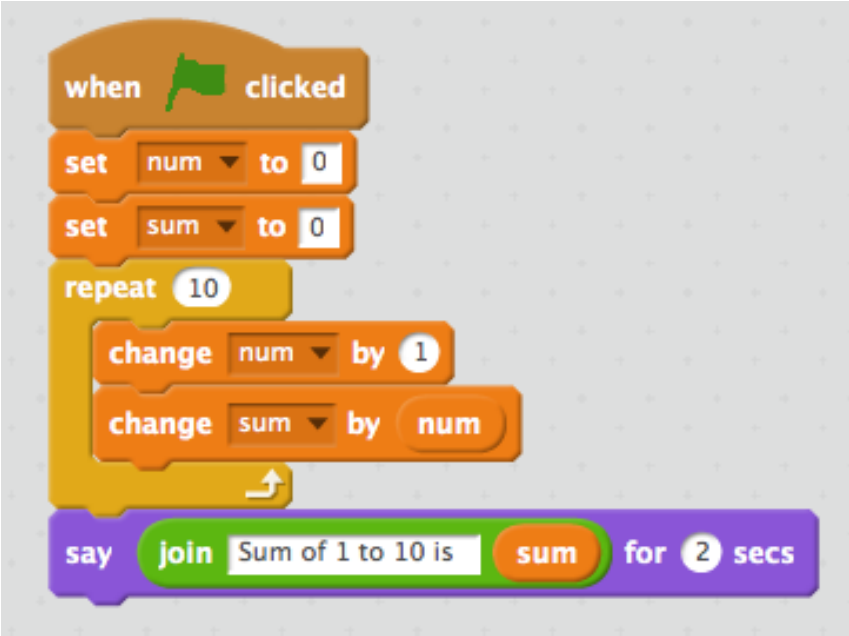
- Get and set co-ordinates
- Get and set heading
- Also
  - Distance
  - Towards

General language concepts
- Variables
- Choice

Translating Scratch & Python

- Same core concepts
- Overlapping problems that can be easily solved

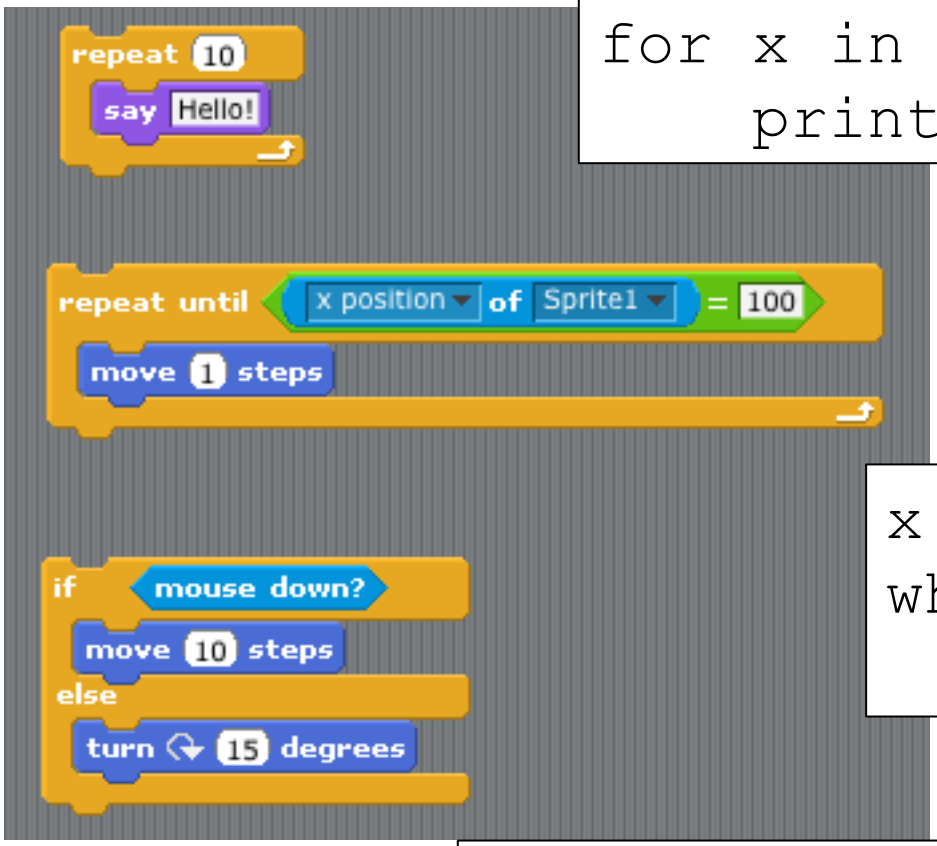
Comparing Shapes and Text



- No punctuation or spelling errors
- Direct representation of inside loop
  - Indentation (Python)
  - Brackets (C, Java, …)

```
num = 0
sum = 0
while x <= 10:
    x = x + 1
    sum = sum + num
print('Sum … is', sum)
```

Control Statements – Close




```
for x in range(1, 10):
    print("Hello")
```

```
x = 0
while x != 100:
    forward(1)
```

```
if mouseDown():
    forward(10)
else:
    right(15)
```

Variables – Set and Change

- Later in scratch

Variables:
- Sprite
- Global

Value of the variables

```
Steps = 0
```

```
Steps = Steps + 1
```

Python uses name for both left and right hand side of assignment

Programming Concepts

Concept	Comparison
Arithmetic operators	Very similar
Logical operators	Very similar
Selection	Very similar
Loops	Scratch has more forms
Variables and types	Scratch does not distinguish strings from numbers
Assignment	Clearer in Scratch
Input and output	Scratch equivalents for input / print
Broadcast	No direct equivalent: decomposition
Functions	Similar
Sprites	No direct equivalent

Introduce Assignment

- Exploit different syntax to emphasise that assignment is not equality
- Python

```
Total = Total + ItemCost * Number
```

- Means the same as:

Practical Problems

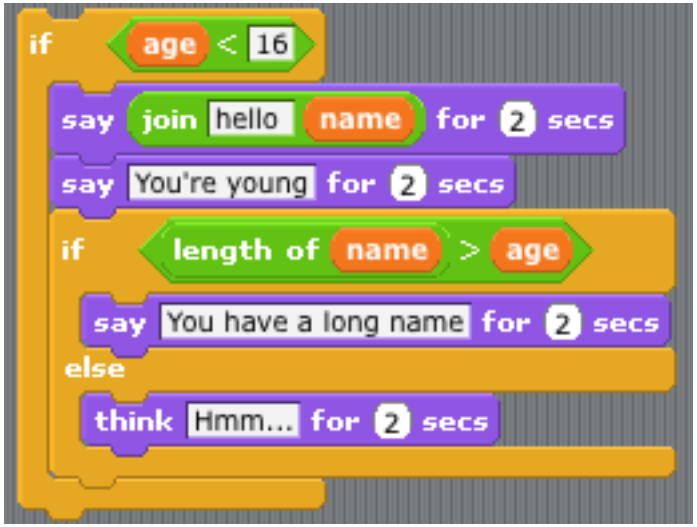
Equivalence

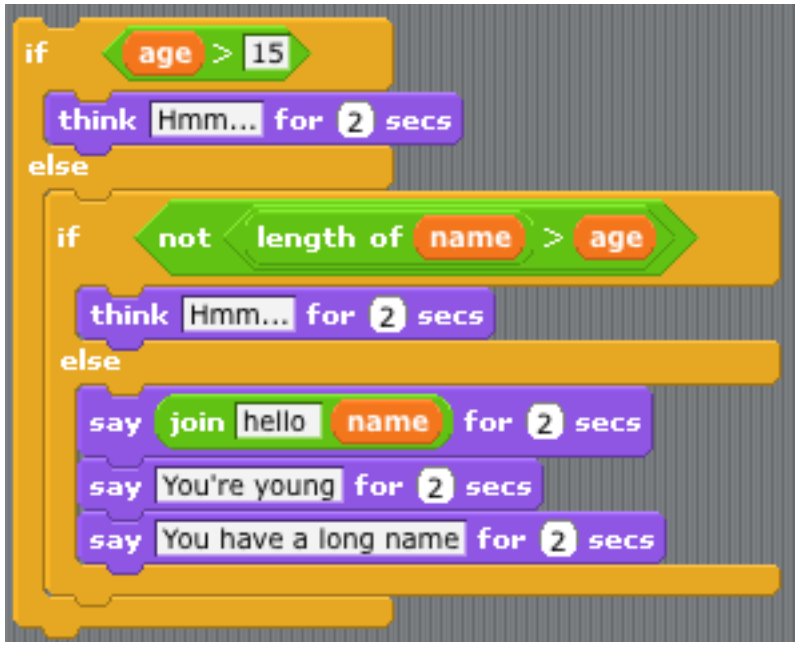
- Two programs can have same behaviour
  - Different forms of ‘if’ or ‘loop’
  - Logical equivalence
  - Repetition versus loops

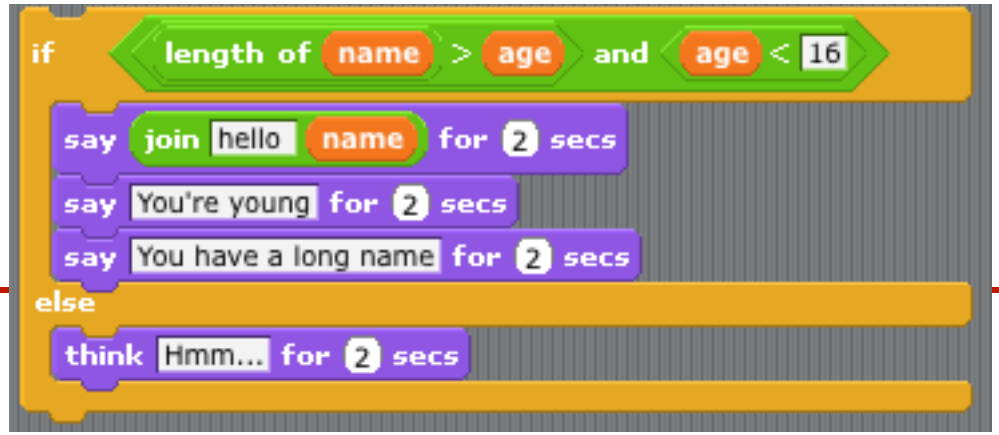
- Redundant code
  - Code that makes no difference
  - Easy to include this in Scratch

Problem 1: If & Logic

- Two variables: 'name and 'age'
- Which versions are the same?

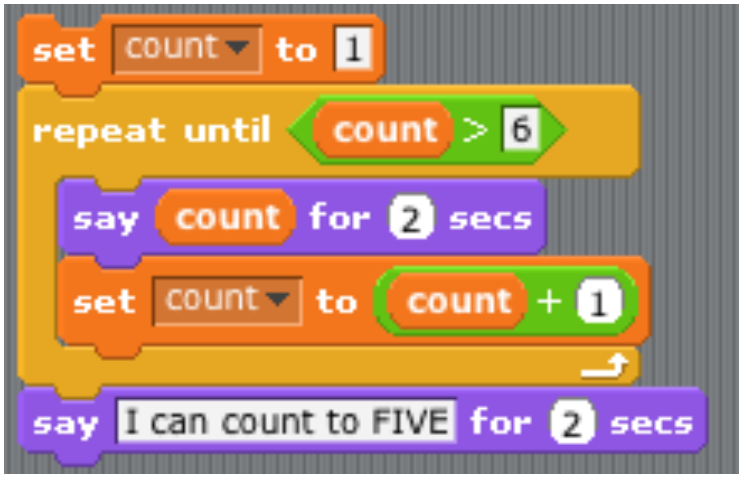


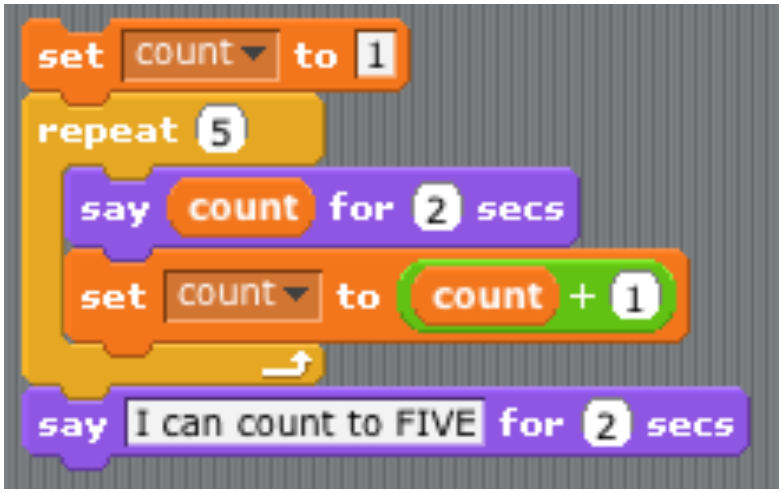


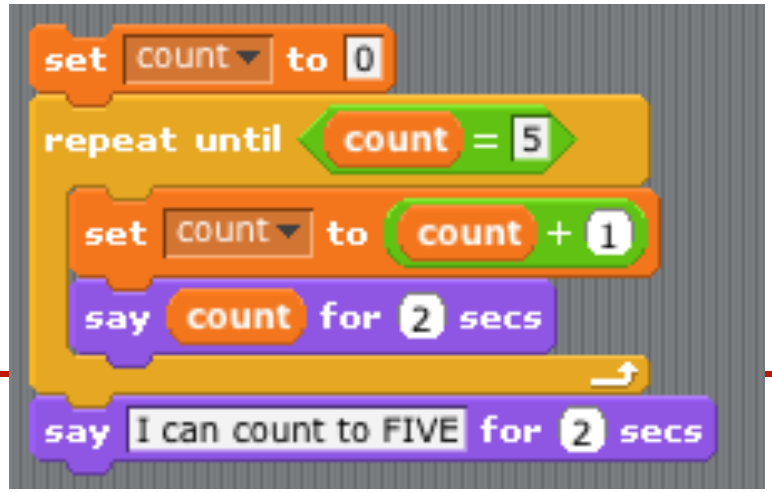


Problem 2: Counting to 5

- Which are the same?







Summary

- Ideas for transferring from visual to textual programming
- Core programming concepts: make the correspondence explicit
- Problem solving, abstraction and decomposition: build on existing ideas