

COMP110: Principles of Computing

3: Flowcharts and pseudocode

Learning outcomes

- ▶ Produce and explain basic flowcharts
- ▶ Produce and explain basic pseudocode

Worksheet B

- ▶ Flowcharts and pseudocode
- ▶ Due in class **next week**
- ▶ Online quiz will be released **next week** and due **the week after**

Algorithms



What is an algorithm?

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A **sequence of instructions** which can be followed **step by step** to perform a **computational task**.

Programs vs algorithms

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 - ▶ E.g. Microsoft Word is not an algorithm, but it implements many algorithms
 - ▶ E.g. it implements an algorithm for determining where to break a line of text, how much space to add to centre a line, etc.

Algorithms outside computing

- 1 Preheat the oven to 180C, gas 4.
- 2 Beat together the eggs, flour, caster sugar, butter and baking powder until smooth in a large mixing bowl.
- 3 Put the cocoa in separate mixing bowl, and add the water a little at a time to make a stiff paste. Add to the cake mixture.
- 4 Turn into the prepared tins, level the top and bake in the preheated oven for about 20-25 mins, or until shrinking away from the sides of the tin and springy to the touch.
- 5 Leave to cool in the tin, then turn on to a wire rack to become completely cold before icing.
- 6 To make the icing: measure the cream and chocolate into a bowl and carefully melt over a pan of hot water over a low heat, or gently in the microwave for 1 min (600w microwave). Stir until melted, then set aside to cool a little and to thicken up.
- 7 To ice the cake: spread the apricot jam on the top of each cake. Spread half of the ganache icing on the top of the jam on one of the cakes, then lay the other cake on top, sandwiching them together.
- 8 Use the remaining ganache icing to ice the top of the cake in a swirl pattern. Dust with icing sugar to serve.

How To Solve A Rubik's Cube

THINGS TO KNOW BEFORE YOU START

- The square in the middle of one side indicates that color; colors are given square in given side.
- Always hold the cube so the "Front" face is towards you when completing moves.
- The "I" indicates the move is inverted or counter-clockwise in rotation.
- Each turn is 1/4 turn unless noted "90°".

MOVES

FRONT (F)	LEFT (L)	RIGHT (R)	UP (U)	DOWN (D)
FRONT INVERSE (F')	LEFT INVERSE (L')	RIGHT INVERSE (R')	UP INVERSE (U')	DOWN INVERSE (D')

LETTERS

For Middle Letters

STEP 1: CROSS

A. Locate the corner pieces in bottom layer and rotate it to its corresponding corner position.

B. Do sequence: R U D U

C. Repeat until corner is in the top layer, corner is placed.

D. Repeat until corner is in the top layer, corner is placed.

E. Repeat until corner is in the top layer, corner is placed.

F. Repeat until corner is in the top layer, corner is placed.

G. Repeat for other 3 corners.

H. Repeat for other 3 corners.

I. Repeat for other 3 corners.

J. Repeat for other 3 corners.

K. Repeat for other 3 corners.

L. Repeat for other 3 corners.

M. Repeat for other 3 corners.

N. Repeat for other 3 corners.

O. Repeat for other 3 corners.

P. Repeat for other 3 corners.

Q. Repeat for other 3 corners.

R. Repeat for other 3 corners.

S. Repeat for other 3 corners.

T. Repeat for other 3 corners.

U. Repeat for other 3 corners.

V. Repeat for other 3 corners.

W. Repeat for other 3 corners.

X. Repeat for other 3 corners.

Y. Repeat for other 3 corners.

Z. Repeat for other 3 corners.

AA. Repeat for other 3 corners.

AB. Repeat for other 3 corners.

AC. Repeat for other 3 corners.

AD. Repeat for other 3 corners.

AE. Repeat for other 3 corners.

AF. Repeat for other 3 corners.

AG. Repeat for other 3 corners.

AH. Repeat for other 3 corners.

AI. Repeat for other 3 corners.

AJ. Repeat for other 3 corners.

AK. Repeat for other 3 corners.

AL. Repeat for other 3 corners.

AM. Repeat for other 3 corners.

AN. Repeat for other 3 corners.

AO. Repeat for other 3 corners.

AP. Repeat for other 3 corners.

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AS. Repeat for other 3 corners.

AT. Repeat for other 3 corners.

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AV. Repeat for other 3 corners.

AW. Repeat for other 3 corners.

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BJ. Repeat for other 3 corners.

BK. Repeat for other 3 corners.

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BM. Repeat for other 3 corners.

BN. Repeat for other 3 corners.

BO. Repeat for other 3 corners.

BP. Repeat for other 3 corners.

BQ. Repeat for other 3 corners.

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BV. Repeat for other 3 corners.

BW. Repeat for other 3 corners.

BX. Repeat for other 3 corners.

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BZ. Repeat for other 3 corners.

CA. Repeat for other 3 corners.

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CE. Repeat for other 3 corners.

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CN. Repeat for other 3 corners.

CO. Repeat for other 3 corners.

CP. Repeat for other 3 corners.

CQ. Repeat for other 3 corners.

CR. Repeat for other 3 corners.

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CT. Repeat for other 3 corners.

CU. Repeat for other 3 corners.

CV. Repeat for other 3 corners.

CW. Repeat for other 3 corners.

CX. Repeat for other 3 corners.

CY. Repeat for other 3 corners.

CZ. Repeat for other 3 corners.

DA. Repeat for other 3 corners.

DB. Repeat for other 3 corners.

DC. Repeat for other 3 corners.

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DE. Repeat for other 3 corners.

DF. Repeat for other 3 corners.

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DM. Repeat for other 3 corners.

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DP. Repeat for other 3 corners.

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DY. Repeat for other 3 corners.

DZ. Repeat for other 3 corners.

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EC. Repeat for other 3 corners.

ED. Repeat for other 3 corners.

EE. Repeat for other 3 corners.

EF. Repeat for other 3 corners.

EG. Repeat for other 3 corners.

EH. Repeat for other 3 corners.

EI. Repeat for other 3 corners.

EJ. Repeat for other 3 corners.

EK. Repeat for other 3 corners.

EL. Repeat for other 3 corners.

EM. Repeat for other 3 corners.

EN. Repeat for other 3 corners.

EO. Repeat for other 3 corners.

EP. Repeat for other 3 corners.

EQ. Repeat for other 3 corners.

ER. Repeat for other 3 corners.

ES. Repeat for other 3 corners.

ET. Repeat for other 3 corners.

EU. Repeat for other 3 corners.

EV. Repeat for other 3 corners.

EW. Repeat for other 3 corners.

EX. Repeat for other 3 corners.

EY. Repeat for other 3 corners.

EZ. Repeat for other 3 corners.

FA. Repeat for other 3 corners.

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FC. Repeat for other 3 corners.

FD. Repeat for other 3 corners.

FE. Repeat for other 3 corners.

FF. Repeat for other 3 corners.

FG. Repeat for other 3 corners.

FH. Repeat for other 3 corners.

FI. Repeat for other 3 corners.

FJ. Repeat for other 3 corners.

FK. Repeat for other 3 corners.

FL. Repeat for other 3 corners.

FM. Repeat for other 3 corners.

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GH. Repeat for other 3 corners.

GI. Repeat for other 3 corners.

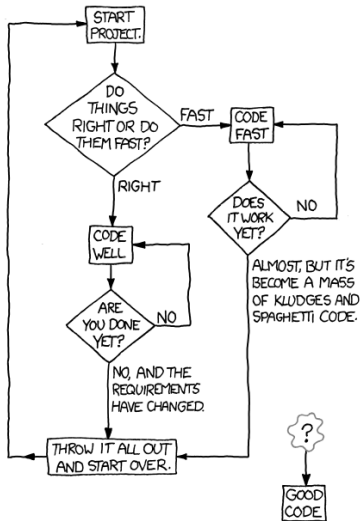
GJ. Repeat for other 3 corners.

GK. Repeat

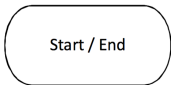
Flowcharts



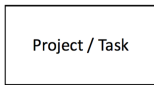
HOW TO WRITE GOOD CODE:



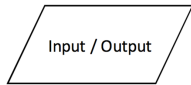
Flowchart symbols



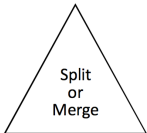
The start or end of a workflow.



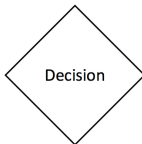
Process or action.



Data: Inputs to, and outputs from, a process.



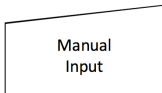
Upright indicates a process split,
inverted indicates a merge of processes.



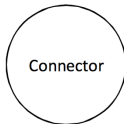
Decision point in a
process or workflow.



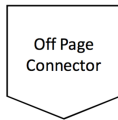
Document or report.



Prompt for information, manually
entered into a system.

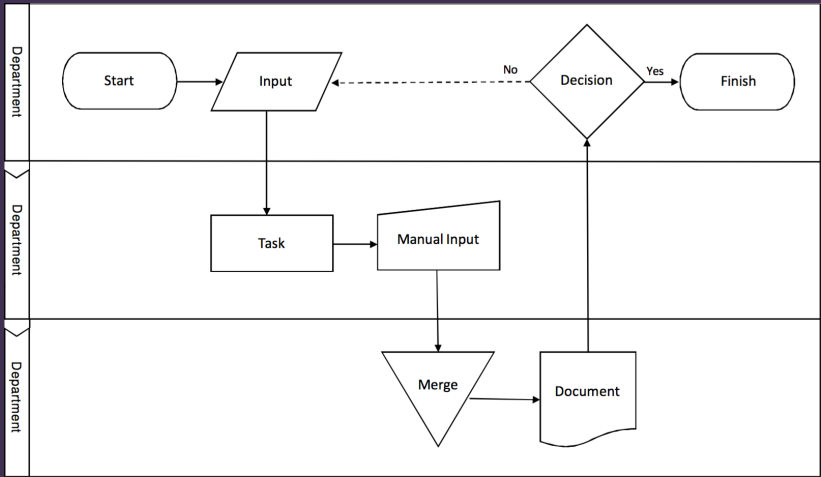


Used to connect one part of
a flowchart to another.



Connector used to connect one
page of a flowchart to another.

Swimlanes



Activity

- ▶ In **groups of 2-3**
- ▶ **Draw** a flowchart for **logging into Facebook**
- ▶ Draw your flowchart using **pen and paper**
- ▶ Include at least two swimlanes: **the user's browser/device** and **the Facebook server**
- ▶ Take a **photo** of your flowchart and post it on **Slack**

Software for drawing flowcharts

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Intended for drawing flowcharts:

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If you're desperate:

- ▶ Any drawing package (Inkscape, Adobe Illustrator, Apple Keynote, ...)
- ▶ MS Paint

Pseudocode



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Pseudocode

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Pseudocode expresses an algorithm in a way that looks more like a structured program

Pseudocode example

```
print "How old are you?"  
read age  
if age < 13 then  
    print "You are a child"  
else if age < 18 then  
    print "You are a teenager"  
else  
    print "You are an adult"  
end if
```

Pseudocode example

```
sum  $\leftarrow$  0                                ▷ initialisation  
for i in 1, ..., 9 do  
    sum  $\leftarrow$  sum + i  
end for  
print sum                                ▷ print the result
```


Pseudocode example

```
 $a \leftarrow 1$                                 ▷ initialisation  
while  $a < 100$  do  
     $a \leftarrow a \times 2$   
end while  
print  $a$                                 ▷ print the result
```

Formatting pseudocode

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- ▶ **Not** important: adhering to a strict set of style guidelines, ensuring direct translatability to your chosen programming language

Level of abstraction

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Whether working with flowcharts or pseudocode, choose your **level of abstraction** carefully

Level of abstraction: Good

Fill kettle

Turn kettle on

Put instant coffee in mug

if sugar wanted **then**

 Add sugar

end if

Wait for kettle to boil

if milk wanted **then**

 Pour water to $\frac{4}{5}$ full

 Add milk

else

 Fill mug with water

end if

Stir

Level of abstraction: Not so good

Position kettle beneath tap

Turn tap on

while water is below halfway point **do**

 Wait

end while

Turn tap off

Place kettle on base

Press power button

...

Level of abstraction: Silly

Place right palm on kettle handle

Bend fingers on right hand

Lift arm upwards

while tap spout is not directly above kettle **do**

 Move arm to the right

end while

Place left palm on tap handle

Bend fingers on left hand

Rotate left hand

...

Level of abstraction: also silly

Make a cup of coffee

Activity

A number guessing game: The computer chooses a number between 1 and 20 at random. The player guesses a number. The computer says whether the guessed number is “too high”, “too low” or “correct”. The game ends when the correct number is guessed, or after 5 incorrect guesses.

- ▶ In **groups of 2-3**
- ▶ **Write** pseudocode for the number guessing game
- ▶ **Post** your pseudocode on Slack

Activity

- ▶ In **groups of 2-3**
- ▶ **Choose** an algorithm from one of the following:
 - ▶ Lego Robot Olympiad
 - ▶ COMP120 Tinkering Graphics
 - ▶ COMP150 Game Development Project
- ▶ **Express** the algorithm as a flowchart **and**
- ▶ **Express** the algorithm as pseudocode
- ▶ **Post** both your flowchart and your pseudocode on Slack