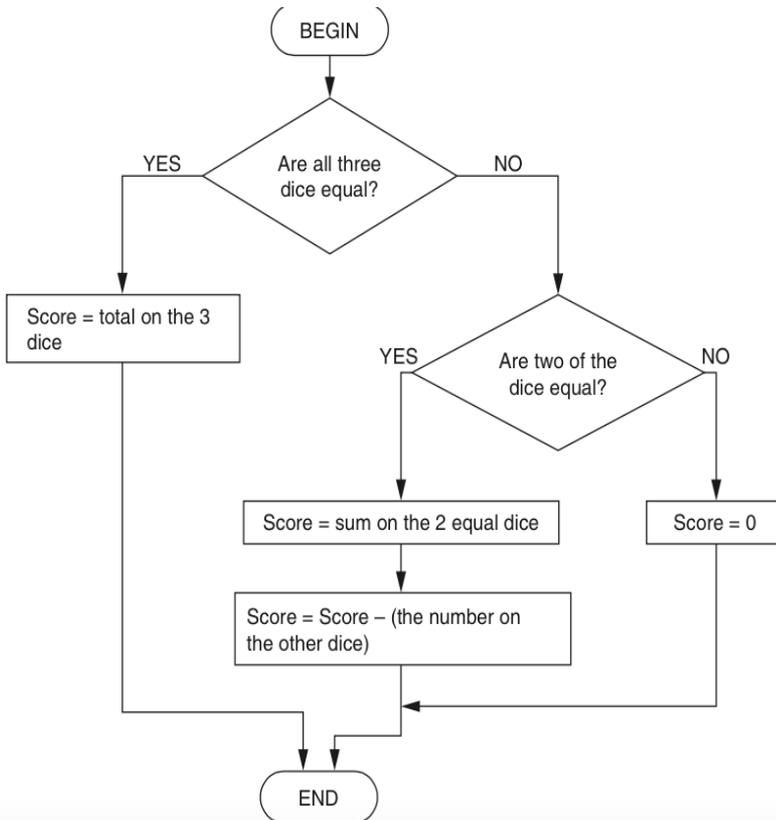# Programming Challenge 1

Frances is writing a program which simulates a dice game played with three ordinary 6-sided dice. When the player rolls the three dice, the player is given points according to the algorithm expressed in the flow diagram below.

1) This program requires input, variables, type casting and some if statements to produce the correct outputs – GRADE 5

Stretch and Challenge:

- Repeats
- Random number for dice generation
- Error trapping – cant put a number bigger than 6 in
- Functions
- Adding dice rolls to a list
- Writing three dice rolls and output to a csv file

The routine for rolling the dice is written as a sequence below.

BEGIN RollTheDice
DiceResult(1) = Random Number between 1 and 6
DiceResult(2) = Random Number between 1 and 6
DiceResult(3) = Random Number between 1 and 6
END

Rewrite this routine so that it uses iteration.

Programming Challenge 1 – To Get You Started

```
Dice1=INPUT Number
Dice2=INPUT Number
Dice3=INPUT Number

IF Dice1==Dice2 AND Dice2==Dice3:
    OUTPUT Dice1+Dice2+Dice3

ELIF Dice1==Dice2:
    OUTPUT (Dice1+Dice2)-Dice3

…
```

Programming Challenge 2

A program contains the following code to calculate the circumference of a bicycle wheel, using the wheel size (diameter).

```
BEGIN
CONSTANT Pi = 3.14
INPUT WheelSize
Circumference = Pi * WheelSize
OUTPUT Circumference
END
```

1) This program requires input, variables, type casting and a calculation to produce an output– GRADE 4

Stretch and Challenge:

- Repeats
- Error trapping – can only enter a number
- Written as a reusable function
- Adding wheelsize and circumference to a list
- Writing the wheel size and circumference to a CSV file

Programming Challenge 3

A dog that is 5 years old is equivalent to a 42 year old human. Ashok is writing a program which converts the age of a dog to the equivalent age for a human.
The program uses the following method:

```
The user inputs age of the dog in years
If the age is 2 or less, the human equivalent is 12 times the age
If the age is more than 2, the human equivalent is 24 for the
```

1) This program requires input, variables, type casting and if statements to produce the correct output– GRADE 5

Stretch and Challenge:

- Repeats
- Error trapping – can only enter a number
- Functions written
- Ask for name – it then stores name, and both ages in a list and then written to a csv file
- New program which can pull in contents of csv file and produce two lists – dogs oldest to youngest and dogs youngest to oldest

Programming Challenge 3 – to get you started

```
Age=INPUT Dog age

If Age<=2:
    print (12*age)

Else:

…
```

Programming Challenge 4

Debbie has a program on her mobile phone, which calculates the cost of the calls she has made.

```
PROCEDURE Update
      TotalCalls = TotalCalls + 1
      IF SameNetwork = TRUE THEN
         RunningCost = RunningCost + 0.01
      ELSE
         RunningCost = RunningCost + (CallLength * 0.10)
      END IF
  END PROCEDURE Update
```

1) This program is Grade 6 as you will need to think about what data you will need to collect from the user first and how you will implement this code above and then think about what you will output back to the user.

<u>Stretch and Challenge:</u>

- Repeats
- Error trapping – can only enter a numbers in the correct place, deals with different cases etc
- Functions written
- Adds the data to a list
- Creates a call log in a CSV file
- New program to pull in the data from a CSV file and produces a sorted list from longest call to shortest call, and then shortest call to longest call

Programming Challenge 4 – to get you started

```
TotalCalls=0
RunningCost=0
YourNetwork="EE"

INPUT CallLength
INPUT Network

TotalCalls = TotalCalls + 1
IF YourNetwork==Network:
     RunningCost = RunningCost + 0.01
ELSE
        RunningCost = RunningCost + (CallLength * 0.10)

OUTPUT CallLength
OUTPUT RunningCost
```

Programming Challenge 5

Zak is writing a program that uses an array called WordList. This array contains 10 foreign words in alphabetical order. The contents of the array are shown below.

WordList (1)	akesi
WordList(2)	esun
WordList(3)	jaki
WordList(4)	kala
WordList(5)	lipu
WordList(6)	mama
WordList(7)	nasa
WordList(8)	olin
WordList(9)	taso
WordList(10)	walo

1) Zak needs to write a routine that: allows the user to input a word ,goes through the items in the array WordList in turn, starting from the WordList(1) ,if it finds the word that the user has input, it outputs "Word found".

Grade 6 – creating a list and iterating through it

Stretch and Challenge:

- Repeats – so asks you for another word to find
- Error trapping – can only enter text and deals with different cases
- Functions written
- Adds the data to a list
- More words can be added to the list
- Once word has been added to the list is re sorts them
- Tells you what position in the list the word is too

Programming Challenge 6

A mail-order company buys dresses from America and France to sell in the UK.
The company uses the following algorithm to convert sizes before printing them in its catalogue. Half sizes are not possible (e.g. size 12.5).

```
INPUT Size INPUT Origin IF Origin = "America" THEN
Size = Size + 2 ELSE
IF Origin = "France" THEN Size = Size - 26
END IF END IF
PRINT Size
```

1) Grade 4 – Input, Variables, Type Casting and If statement to produce correct output

Stretch and Challenge:

- Repeats
- Error trapping – can only enter America or France, dealing with different cases, can only enter a number for size
- Functions written
- Adds the data to a list
- List is written to a csv file

Programming Challenge 7

The program in a vending machine uses an array called Coins to store the value in pence of all the coins that have been entered in the current sale. A maximum of 10 coins can be entered in each sale. After each sale, the array is reset so that all values are 0.

Here is an example of the contents of the array Coins during a sale.
10,100,20,50,0,0,0,0,0,0

1) Write a program that creates a list with ten entries all of 0 at the start of the program. It must then produce a total. Grade 5/6 as using lists.

Stretch and Challenge:

- Repeats – so next user of the vending machine
- Error trapping – can only enter a number, or can only enter 0,1,2,5,10,20,50,100,200
- Functions written

Programming Challenge 8

A program allows users to input the message to be displayed and the number of times it should display. Allows the user to input the message and the number of displays. Rejects the message if it is longer than 20 characters and stops. Otherwise it repeatedly displays the message and clears the display for the correct number of times.
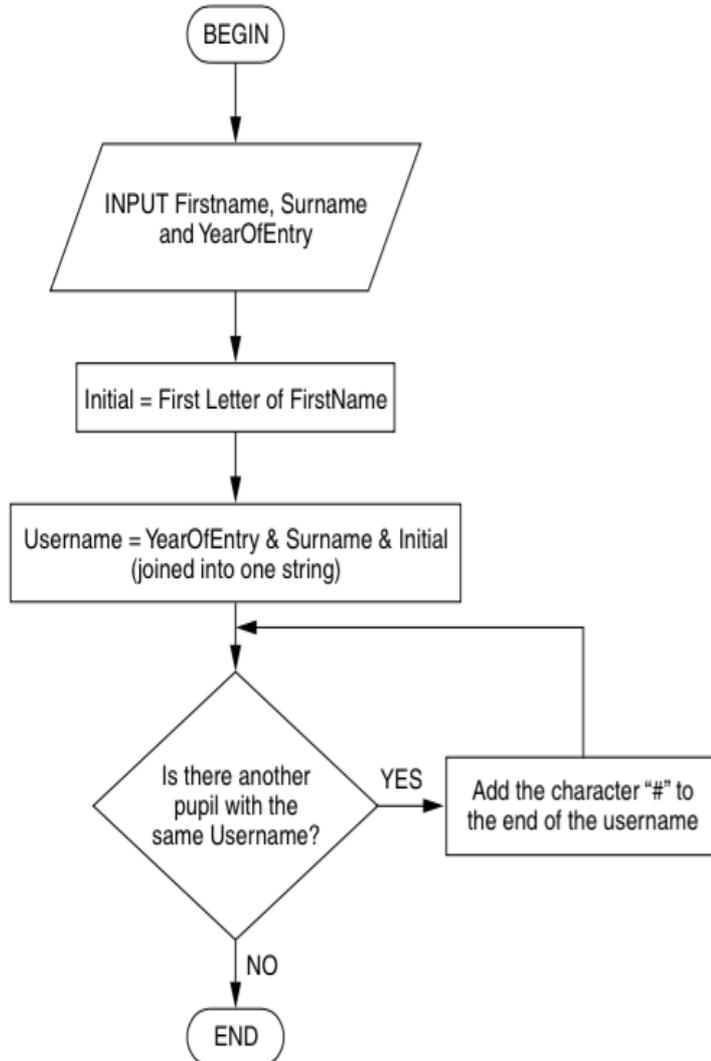
1) Grade 5– Input, variable, type casting, length check, if statements to produce correct result, iteration for repetition

Stretch and Challenge:

- Repeats – so asks for the next message
- Error trapping – can only enter a number etc in the right place
- Functions written
- Writes messages to a list and then a csv file
- Use CSV file in another program to create a sorted list of messages

Programming Challenge 9

A school uses a computer program to give every new pupil a username for logging onto computers. The algorithm used to choose the username is shown below.

1) Grade 7– Input, variable, type casting, joining strings, string slicing, iterating through a list to see if exists

Stretch and Challenge:

- Repeats – so asks for the next students
- Error trapping – can only enter a number etc in the right place
- Functions written
- Writes first name, surname, year of entry, username to a list and then onto a csv file
- New program that uses CSV file to produced a list of students in alphabetical order

Flowchart:

BEGIN

INPUT Firstname, Surname and YearOfEntry

Initial = First Letter of FirstName

Username = YearOfEntry & Surname & Initial (joined into one string)

Is there another pupil with the same Username? — YES → Add the character "#" to the end of the username

NO

END

Programming Challenge 10

The cost of a day-time journey is £3 for the first kilometre and £2 for every kilometre after that. If there are five or more passengers in the taxi, an extra 50% is added to the charge.
Write an program to calculate the cost of a day-time journey.
Your program should:
allow the number of passengers and the distance of the journey to be input as whole
  numbers,
calculate the cost of the journey,
output the cost that has been calculated.

1) Grade 5– Input, variable, type casting, if statements to produce correct output

Stretch and Challenge:

*   Repeats – so asks for the next journey
*   Error trapping – can only enter a number etc in the right place
*   Functions written
*   Writes fdata to a list
*   Writes data to a CSV file to produce a journey log
*   New program that uses csv file and produces a list that shows most expensive journey down to least expensive journey

Programming Challenge 11

Jim is writing a program to calculate the wages of workers in a teddy bear factory. The wages earned by a worker is either £2 for every teddy bear they have made or £5 for every hour they have worked, whichever is larger. Write a program that: allows the user to input the number of teddy bears made and the number of hours worked ,calculates the wages for the number of teddy bears made ,calculates the wages for the number of hours worked ,outputs the larger of the two results.

Workers sometimes get a £50 bonus. Here is the algorithm used to calculate whether a worker should get a bonus.

```
Limit = 200
    INPUT WagesEarned
    IF WagesEarned < Limit THEN
        Pay = WagesEarned
    ELSE
        Pay = WagesEarned + 50
    END IF
```

1) Grade 5– Input, variable, type casting, if statements to produce correct output

Stretch and Challenge:

- Repeats – so asks for the next worker
- Error trapping – can only enter a number etc in the right place
- Functions written
- Writes data to a list – also asking for their name too
- Writes data to a CSV file t
- New program that uses csv file and produces a list that shows highest earner down to least

Programming Challenge 12

Jim is writing a program to calculate the wages of workers in a teddy bear factory. The wages earned by a worker is either £2 for every teddy bear they have made or £5 for every hour they have worked, whichever is larger. Write a program that: allows the user to input the number of teddy bears made and the number of hours worked ,calculates the wages for the number of teddy bears made ,calculates the wages for the number of hours worked ,outputs the larger of the two results.
Workers sometimes get a £50 bonus. Here is the algorithm used to calculate whether a worker should get a bonus.

```
Limit = 200
    INPUT WagesEarned
    IF WagesEarned < Limit THEN
        Pay = WagesEarned
    ELSE
        Pay = WagesEarned + 50
    END IF
```

1) Grade 5– Input, variable, type casting, if statements to produce correct output

Stretch and Challenge:

- Repeats – so asks for the next worker
- Error trapping – can only enter a number etc in the right place
- Functions written
- Writes data to a list – also asking for their name too
- Writes data to a CSV file t
- New program that uses csv file and produces a list that shows highest earner down to least

Programming Challenge 13

Santos is writing a program that guesses the number of goals a team will score in a football match.

The algorithm for his program is shown below:

```
CONST Noise = 10
INPUT Wins
INPUT Losses
Goals = 0
Net = Wins - Losses
WHILE Net > Noise
        Goals = Goals + 1
        Net = Net - Noise
END WHILE
OUTPUT Goals
```
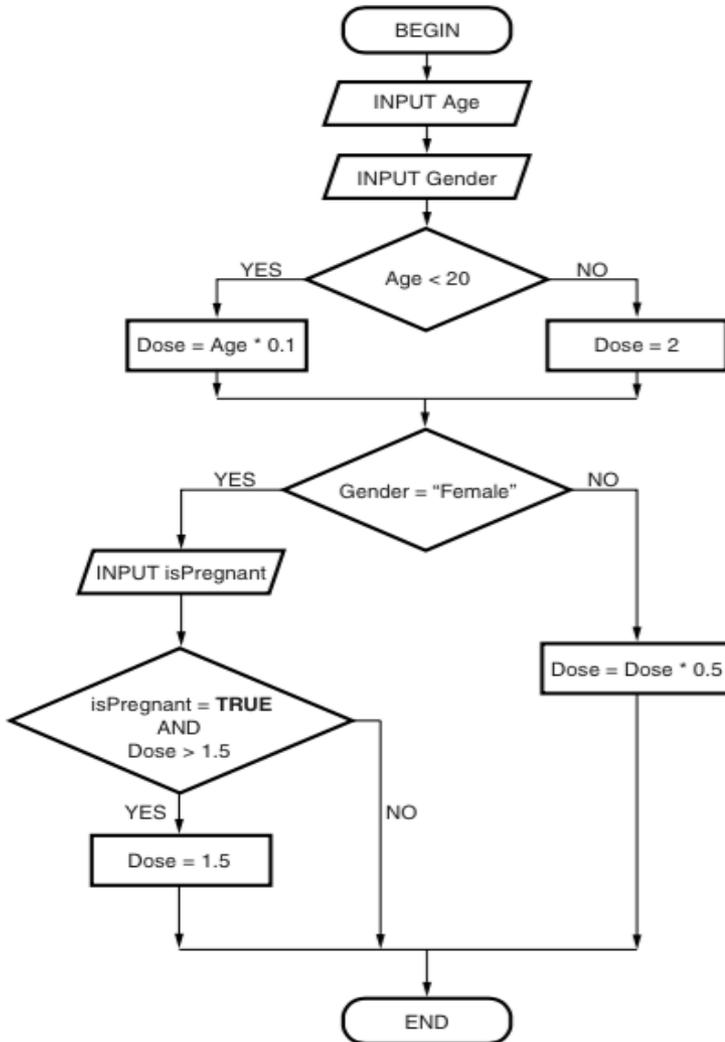
1) Grade 5– Input, variable, type casting, while loop to produce correct output

Stretch and Challenge:

- Repeats – so asks for the next set of data
- Error trapping – can only enter a number etc in the right place
- Functions written
- Writes data to a list
- Writes data to a CSV file
- New program that uses csv file and produces a list that shows highest goals down to least

Programming Challenge 14

A computer program calculates the correct dose in grams of a type of medicine. The algorithm used is shown by the flow diagram below.
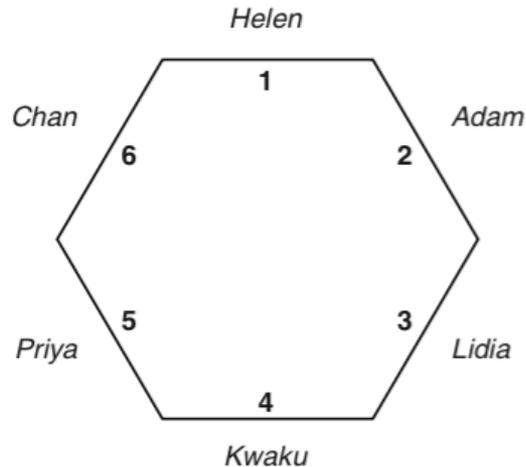

1) Grade 5– Input, variable, type casting, if statements to produce correct output

Stretch and Challenge:

- Repeats – so asks for the next patient
- Error trapping – can only enter a number etc in the right place
- Functions written
- Writes data to a list with name of patient
- Writes data to a CSV file
- New program that uses csv file and produces a list that shows patients in alphabetical order

Programming Challenge 15

A game on a computer shows six players around a table on seats. They are numbered 1 to 6 as shown below.

Helen

1

Chan   Adam

6   2

5   3

Priya   Lidia

4

Kwaku

The names of the players are stored in an array with six elements called PlayerName. The index position of the array is used to indicate the seat number. During the game, each player sometimes moves clockwise by a given number of places. Write an algorithm that will update the contents of the array PlayerName after a move has occurred.

1) Grade 6– Input, variable, type casting, using iteration and lists

Stretch and Challenge:

- Repeats – so asks for the next move
- Error trapping – can only enter a number etc in the right place
- Functions written
- Writes data to a CSV file

Programming Challenge 16

A memory game is played where:
- three players (A, B and C) have to choose a number between 0 and 100
- if the number has already been chosen, a message is displayed that says `"taken"`
- if the number has not already been chosen, the player's letter is placed next to it
- the quantity of numbers that have not yet been chosen is displayed.

The winner is the player who has chosen the most unique numbers by the end of the game.

The numbers are stored in an array; `numbers()`. A number that has not yet been chosen is stored as an empty string "". The players are represented by `"A"`, `"B"` and `"C"`.

Fig. 5 shows an extract from the array:

Number:	0	1	2	3	4	...	...	99	100
Player:	A	C	B		A			B	

Fig. 5

1) Grade 6– Input, variable, type casting, using iteration and lists

Stretch and Challenge:

- Repeats – so asks for the next patient
- Error trapping – can only enter a number etc in the right place
- Functions written
- Writes data to a CSV file