

## End of topic quiz – Topic 2.2 Programming fundamentals

1.

- a. Compare the use of **variables** and **constants** in a computer program, giving one similarity and one difference. [2 marks]

- b.(i) A programmer creates the following code:

```
01 y = input("enter a number")
02 x = y MOD 5
03 if x == 0 then
04   print (True)
05 endif
```

How is the = sign on line 02 and line 03 used differently? [1 mark]

- b.(ii) What is one input that would cause the program to output **True** and explain why this is the case? [2 marks]

- b.(iii) What are the **two** basic programming constructs that have been used in the code above? [2 marks]

- b.(iv) What is the name of **one** programming construct that has **not** been used in the code above and give an example of how this construct could be used? [2 marks]

2. A programmer is developing a fitness app that will challenge the user to complete one of three physical activities each week.

- a. Write program code that will generate a random number between 1 and 3. [1 mark]

- b. Create an algorithm that will generate a random number between 1 and 3 and then use this to display a message to either walk 10km, run 5km or swim 1km. [4 marks]

3. Create an algorithm that will allow the user to enter a word and then count how many times the letter A appears in that word. Both upper case ("A") and lower case ("a") letters must be counted. The algorithm should repeat until a word is entered that has 3 or more letter As.  
[4 marks]

4. a. The following algorithm prints out the times table of the number entered using a **count controlled** loop.

```
01 b = input("Enter a number")
02 for x = 1 to 100
03   print(b * x)
04 next
```

Rewrite the algorithm to produce the same result using a **condition controlled** loop. [2 marks]

- b. Write an algorithm that will ask the user for their age in years and then print the message “happy birthday” that many times. [4 marks]

5.

- a. Complete the data type column on the below table to show the **most appropriate** data type for each: [4 marks]

Data recorded	Example data	Data type
Number of goals scored	2	
Training venue	New Trent Park	
Session completed (True / False)	True	
Best sprint time (seconds)	12.7	

- b. What is meant by the term **casting** in relation to data types? [1 mark]

- c. The data from part (a) is stored in an array called `trainingdata`. The training sessions are stored in a text file called `allsessions.txt`

Finish the algorithm below to add the new `trainingdata` to the text file. [2 marks].

```
trainingdata = ["2", "New Trent Park", "True", "12.7"]
```

- d. Using the `trainingdata` array from the previous question, give the pseudocode that a programmer would use to output just the training venue details (`"Bycars Park"`) from this array. You may assume that the array is zero-indexed. [1 mark]

- e. How could a 2 dimensional array be used to allow a programmer to hold details of multiple training sessions? [1 mark]

6.

- a. A database table called *songs* is used to store details of music that is played on an Internet radio station.

The *songs* table is shown below:

MusicID	BandName	SongTitle	Length	Fade
0010	Cold Ice	On the Road	3.20	True
0011	Rainbow Fish	Hanging Out	2.21	False
0012	Willow Fire	The Forest at Night	3.10	False
0013	Cold Ice	Calm Horizon	3.13	False
0014	Rainbow Fish	Living Below	4.30	False
0015	Travelling Light	Fighting Daylight	4.55	True

What is meant by the term **record** when storing data? [1 mark]

- b. Write SQL statements to display the following data from the *songs* table:

(i) Show the SongTitle and Length for all songs by the band Cold Ice. [2 marks]

(ii) Show the SongTitle for all songs that are over 3 minutes in length. [2 marks]

7.

- a. Procedures and functions are both examples of subroutines. What are two advantages of producing modular code using subroutines? [2 marks]

- b. What **two** ways do procedures differ from functions? [2 marks]

- c.(i) A password must have at least 8 characters to be valid.

Using pseudocode, create a function which will accept a password string as a parameter passed into the function, returning True if the password is a valid length or False if it is not valid. [4 marks]

- c.(ii) Use the function defined in part (i) above to check whether "HELLO123" is a valid password, printing out True or False as appropriate. **You must use the function defined in part (i).** [1 mark]

8. Give the result of the following arithmetic expressions where  $a = 3$ ,  $b = 4$ ,  $c = 5$ . Show your working.

a.  $a^b$  [1 mark]

b.  $(c - a)^b$  [1 mark]

c.  $8 * (a + c) / b$  [1 mark]

d.  $(a + b) * (b - c) / (c - a)$  [1 mark]

e.  $(b + c) / a * b$  [1 mark]

9. Write an algorithm that will input two numbers (X and Y). Using MOD and DIV output the whole number part and the remainder for dividing X by Y. [4 marks]



10. What is the output of Z for the following algorithm, when the following numbers are input.  
**A = 27, B = 15, C = 52.**

a.  $Z = A \text{ MOD } 8$  [1 mark]

b.  $Z = C \text{ DIV } B$  [1 mark]

c.  $Z = (A \text{ MOD } 13) + C$  [1 mark]

d.  $Z = (88 \text{ MOD } B) \text{ DIV } (A \text{ MOD } 5)$  [1 mark]

## Answers

1.

- a. Compare the use of **variables** and **constants** in a computer program, giving one similarity and one difference.

Similarity:

Both refer to a memory location

Both are given an identifier

Both are used to store data whilst the program is running

Difference:

Variable's value can be changed / Constant's value cannot be changed whilst the program is running

- b.(i) A programmer creates the following code:

```
01 y = input("Enter a number")
02 x = y MOD 5
03 if x == 0 then
04     print (True)
05 endif
```

How is the = sign on line 02 and line 03 used differently?

Line 02 = is an assignment operator / assigns a value to x

Line 03 = is a comparison operator / compare the value of x with 0.

Do not award for simply rewording the line (e.g. "on line 03, if x is equal to zero then it...")

- b.(ii) What is one input that would cause the program to output **True** and explain why this is the case?

Any integer value that is divisible by 5 (so ends in 5 or 0). E.g. 35, 90, 5. MOD produces the remainder when y is divided by 5.....this has to be zero to allow the output to be True.

- b.(iii) What are the **two** basic programming constructs that have been used in the code above?

Sequence, Selection.

- b.(iv) What is the name of **one** programming construct that has **not** been used in the code above and give an example of how this construct could be used?

Iteration. Any reasonable example (e.g. use of a FOR / WHILE loop, any reference to looping or repeating code).

2. A programmer is developing a fitness app that will challenge the user to complete one of three physical activities each week.
- Write program code that will generate a random number between 1 and 3.

```
random(1,3)  
Accept alternatives
```

- Create an algorithm that will generate a random number between 1 and 3 and then use this to display a message to either walk 10km, run 5km or swim 1km.

**Example:**

```
choice = random(1,3)  
  
if choice == 1 then  
    print("Your challenge is to walk 10km")  
elseif choice == 2 then  
    print("Your challenge is to run 5km")  
elseif choice == 3 then  
    print("Your challenge is to swim 1km")  
endif
```

Generating a random number and assigning it to a variable

Use of a selection statement or case statement

Correct logic to display the appropriate responses

**Alternative example:**

```
choices = ["walk 10km", "run 5km", "swim 1km"]  
text = "Your challenge is to "  
text = text + choices[random(0,2)]  
print(text)
```

3. Create an algorithm that will allow the user to enter a word and then count how many times the letter A appears in that word. Both upper case ("A") and lower case ("a") letters must be counted. The algorithm should repeat until a word is entered that has 3 or more letter As.

**Example:**

```
word = input("Enter a word")
count = 0
while count < 3
  for x = 1 to word.length
    letter = word.substring(x,1)
    if letter.upper = "A" then
      count = count + 1
    endif
  next x
endwhile
```

Inputting word from the user

Initialising a counter variable to 0 at the start

Use of a count controlled loop...

...to loop around until the correct number of times (until 3 As are entered)

Dealing with upper and lower case (e.g. by converting all to upper case)

Checking each individual letter for an A...

...and adding 1 to the counter if an A is found

Alternative solution (especially for students familiar with Python) would be to use .split or treat the string as an array of characters rather than using the FOR loop. This should be credited under bullet point 6 if done correctly. Another Python alternative would be to use string slicing (e.g. treating the string as an array of characters)

4.

- a. The following algorithm prints out the times table of the number entered using a **count controlled** loop.

```
01 b = input("Enter a number")
02 for x = 1 to 100
03     print (b * x)
04 next x
```

Rewrite the algorithm to produce the same result using a **condition controlled** loop.

**Example:**

```
b=input("Enter a number")
x = 1
while x <= 100
    print (b * x)
    x = x + 1
endwhile
```

Repeating the input b line as in line 01

Initialising a variable to use a counter (x used here)

Correct use of condition controlled loop (e.g. WHILE), with the counter being < or <= to 99 or 100 (depending on use – either could be correct)

Repeating the print b \* x line as in line 03.

Manually incrementing the counter variable

Ending the loop correctly (e.g. ENDWHILE)

- b. Write an algorithm that will ask the user for their age in years and then print the message “happy birthday” that many times.

**Example:**

```
age = input("Enter age")
for x = 1 to age
    print("Happy birthday")
next x
```

Inputting the age from the user

Repeating this many times

...Printing out “happy birthday” that many times

5.

- a. Complete the data type column on the below table to show the **most appropriate** data type for each:

Data recorded	Example data	Data type
Number of goals scored	2	Integer
Training venue	New Trent Park	String
Session completed (True / False)	True	Boolean
Best sprint time (seconds)	12.7	Real / Float

- b. What is meant by the term **casting** in relation to data types?

Changing how a variable's data type is interpreted / a temporary conversion of data type.  
Suitable example – e.g. `str(123)` will treat 123 as a string, not an integer / so a string and an integer can be concatenated.

- c. The data from part (a) is stored in an array called `trainingdata`. The training sessions are stored in a text file called `allsessions.txt`

Complete the algorithm below to add the new `trainingdata` to the text file.

```
trainingdata = ["2", "New Trent Park", "True", "12.7"]
```

**Example:**

```
trainingdata = ["2", "New Trent Park", "True", "12.7"]  
(already given)
```

```
open allsessions.txt...  
...for append  
write trainingdata  
close file
```

- d. Using the `trainingdata` array from the previous question, give the pseudocode that a programmer would use to output just the training venue details ("New Trent Park") from this array. You may assume that the array is zero-indexed.

```
print (trainingdata[1])
```

- e. How could a 2 dimensional array be used to allow a programmer to hold details of multiple training sessions?

2D array has rows and columns / treated like a table / accessed via two indexes. First index / rows / columns can hold data for one training session. Second index / subsequent rows / columns can hold other training sessions. Suitable example.

6.

- a. A database table called *songs* is used to store details of music that is played on an Internet radio station.

The *songs* table is shown below

MusicID	BandName	SongTitle	Length	Fade
0010	Cold Ice	On the Road	3.20	True
0011	Rainbow Fish	Hanging Out	2.21	False
0012	Willow Fire	The Forest at Night	3.10	False
0013	Cold Ice	Calm Horizon	3.13	False
0014	Rainbow Fish	Living Below	4.30	False
0015	Travelling Light	Fighting Daylight	4.55	True

What is meant by the term **record** when storing data?

A collection of fields/data about one person/thing/entity. Suitable example from the table (could be a whole record from the table or a new record that could be entered into the table).

- b. Write SQL statements to display the following data from the *songs* table:  
(iii) Show the SongTitle and Length for all songs by the band Penguin Steak

```
SELECT SongTitle, Length
FROM songs
WHERE BandName = "Cold Ice"
```

- (iv) Show the SongTitle for all songs that are over 3 minutes in length.

```
SELECT SongTitle
FROM songs
WHERE Length > 3
```

7.

- a. Procedures and functions are both examples of subroutines. What are two advantages of producing modular code using subroutines?

Can reuse code / can use pre-built or external subroutines. Easier to debug / maintain. Work can be split between programmers / programmers can concentrate on their areas of expertise.

- b. What **two** ways do procedures differ from functions?

Procedures are called by their name/functions are called by assign their return value to something. Procedures do not return values. Functions always return a single value.

- c.(i) A password must have at least 8 characters to be valid.

Using pseudocode, create a function which will accept a password string as a parameter passed into the function, returning True if the password is a valid length or False if it is not valid.

**Example:**

```
function checkpassword(password)
if password.length >= 8 then
    return True
else
return False
endfunction
```

Correct function definition with a single value passed in as a parameter  
Check if the length is >= 8...  
...return True if it is  
...return False if it is not.

Does not matter what the function is called or the parameter is called, but this must logically work.

- c.(ii) Use the function defined in part (i) above to check whether "HELLO123" is a valid password, printing out True or False as appropriate. **You must use the function defined in part (i).**

```
print checkpassword("HELLO123")
```



8. Evaluate the following arithmetic expressions where  $a=3$ ,  $b=4$ ,  $c=5$ . Show your working.

a.  $a^b$

$$3^4$$

$$81$$

b.  $(c-a)^b$

$$(5-3)^4=2^4$$

$$16$$

c.  $8*(a+c)/b$

$$8*(3+5)/4=8*8/4=64/4$$

$$16$$

d.  $(a+b)*(b-c)/(c-a)$

$$(3+4)*(4+5)/(5-3)=7*9/2=63/2$$

$$31.5$$

e.  $(b+c)/a*b$

$$(4+5)/3*4=9/3*4=3*4$$

$$12$$

9. Write an algorithm that will input two numbers (X and Y). Using MOD and DIV output the whole number part and the remainder for dividing X by Y.

```

Input x, y
C=x MOD y
D=x DIV y
OUTPUT C,D
    
```

10. What is the output of Z for the following algorithm, when the following numbers are input.  
A=27, B=15, C=52.

a.  $Z=A \text{ MOD } 8$

$Z=27 \text{ MOD } 8$

$3 \text{ r } 3$   
 $\text{MOD} = 3$

b.  $Z=C \text{ DIV } B$

$Z=52 \text{ DIV } 15$

$3 \text{ r } 7$   
 $\text{DIV} = 3$

c.  $Z=(A \text{ MOD } 13)+C$

$Z=(27 \text{ MOD } 13)+52$

$1+52$   
 $53$

d.  $Z=(88 \text{ MOD } B) \text{ DIV } (A \text{ MOD } 5)$

$Z=(88 \text{ MOD } 15) \text{ DIV } (27 \text{ MOD } 5)$

$13 \text{ DIV } 2$   
 $6$

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