

Revision of Algorithms

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Revision Relating to Algorithms and Programming

1.0 Questions Relating to Interpreting Algorithms

Alex is writing a program which keeps track of how long it takes him to run his races.

As part of this program, the **following algorithm below** calculates how many minutes and seconds are contained in a time entered as seconds. For example, 150 seconds is 2 minutes and 30 seconds.

In []:

```
runtime = input(" Enter time in seconds ")
minutes = runtime DIV 60
seconds = minutes MOD 60
```

QUESTION 1 What is meant by the use of DIV in the above algorithm? (2 marks)

ANSWER 1 DIV gives you the quotient when one number is divided by another. So, in the above algorithm, if runtime is set to 150 second, then 150 divided by 60 will be 2 remainder 30 where 2 is the quotient so $150 \text{ DIV } 60 = 2$

QUESTION 2 What is meant by the use of MOD in the above algorithm? (2 marks)

ANSWER 2 MOD gives you the remainder when one number is divided by another. So, in the above algorithm, if runtime is set to 150 seconds, and if you divide 150 by 60 you get 2 remainder 30. So $150 \text{ MOD } 60 = 30$.

2.0 Questions Related to Completing Algorithms

QUESTION 3 Harper is a dentist and schedules appointments for patients. Each appointment is scheduled in blocks of 20 minutes. So for example, an appointment of 1 hour and 20 minutes would be allowed (as that is 80 minutes and it is 4 blocks of 20) whereas an appointment of 2 hours and 18 minutes would not be allowed (as that is 138 minutes and that cannot be divided exactly into blocks of 20).

QUESTION 3 - contd Complete the algorithm below which **implements this restriction**

In []:

```
appointment_duration = input("Enter time in minutes")
hours = appointment_duration DIV 60
minutes = appointment_duration MOD 60

if minutes ----- 20 = 0 then
    print("Time is allowed ")
-----
    print("Time is not allowed")
-----
```

ANSWER 3

```
appointment_duration = input("Enter time in minutes")
hours = appointment_duration DIV 60
minutes = appointment_duration MOD 60

if minutes MOD 20 = 0 then
    " print("Time is allowed ")
ELSE
    ". print("Time is not allowed")
ENDIF
```

Hints to answer the above question In order to be able to successfully answer the types of questions where you are asked to complete algorithms, you should familiarise yourself with the structures of programming constructs related to SELECTION, ITERATION and SEQUENCE.

Practise with these types of Questions You can go to [w3schools.com](https://www.w3schools.com) for practice.

3.0 Questions Related to Writing Algorithms/Programs

QUESTION 4 A tuckshop uses a function called `New_Amount()` to calculate a pupil's new account balance after they have bought some goods.

For example, if a pupil has an account balance of £14.80 and buys some goods from the tuckshop costing £5.50 the `New_Amount()` function should return a new balance of £9.30.

Write a program/algorithm for this function which:-

- (i) Takes the pupil's account balance as a parameter.
- (ii) Takes the cost of the goods bought from the tuckshop as a parameter.
- (iii) Returns the new account balance.

ANSWER 4

In []:

```
def New_Amount(Account_balance, Cost):  
    New_Account_Balance = Account_balance - Cost  
    return(New_Account_Balance)
```

In []:

```
X = New_Amount(14.80, 5.50)  
print("New Account Balance is ", X)
```

QUESTION 5 What is the datatype of the value returned by the function, justify your answer (2 marks)

ANSWER 5 The datatype is real/float.

The justification is that costs are expressed in real numbers.

QUESTION 6 Ladi Supermarkets keeps track of its goods using a tracking code on each of its goods.

Each tracking code is made of 5 characters and starts with the letter Z or letter A.

Write an algorithm/program that:

- (i) Allows a Tracking Code to be Entered
- (ii) Decides if the Tracking Code is Valid or Not.
- (iii) Outputs "Code is Valid" if the above rules are followed and outputs "Code is Not Valid" if the above rules are not followed

ANSWER 6

In [1]:

```
def Track_Code_Valid():
    Tracking_Code = input("Enter Tracking Code")
    if len(Tracking_Code) == 5 and (Tracking_Code[0,1] == 'Z' or Tracking_Code
, [0,1] == 'A'):
        print("Code is Valid")
    else:
        print("Code is not Valid")
```

In [2]:

```
Track_Code_Valid()
```

Code is not Valid

QUESTION 7

Mancho Eateries, a popular vegetarian restaurant, provides a buffet and allows customers to select their food from the buffet. The restaurant allows its customers 2grams free of charge and thereafter charges £5.00 for every extra gram of food. No customer is allowed over 100 grams of food. Write a program/algorithm that:-

- (i) Asks the customers to enter the weight of the food chosen in grams
- (ii) Displays an error message if the food weighs over 100grams
- (iii) If the weight of the food is acceptable, calculates how much the customer is charged

ANSWER 7

In [7]:

```
def Payment():
    Pay=0
    Weight = int(input("Enter the weight of the food in grams "))
    if Weight >= 100:
        print("Error - weight is over 100grams ")
    elif Weight <= 2:
        print("No Payment Due")
    else:
        Pay = (Weight - 2)*5

    return (Pay)
```

```
X = Payment()
print(" Payment Due ", X, "Pounds")
```

Payment Due 260 Pounds

4.0 Questions Related to the Selection of Test Data

QUESTION 8 What test data would you use to test the above algorithm is working?

ANSWER 8

- (1) Weight= 100, this would be boundary, testing a boundary condition and you would expect the program to display the message "Error-weight is over grams "
- (2) Weight = 101, is out of range data or erroneous data, you would expect the program to display the message "Error-weight is over grams "
- (3) Weight = 10, this is in-range data and you would expect the program to display "Payment Due 40 Pounds "
- (4) Weight = 2 - this is boundary data and you would expect the program to display the message "No Payment is Due "
- (5) Weight = 1, this is out-of-range data and you would expect the program to display the message "No Payment Due "

5.0 Questions Relating to Terminology of Programming Terms and Constructs

QUESTION 9 State what Programming Construct is used in the above program?

ANSWER 9 SELECTION

NOTE Please ensure you know what the Programming Constructs - ITERATION, SEQUENCE and SELECTION mean and that you can identify them in a Program.

6.0 Questions Related to Identifying and Correcting the Errors in Programs

QUESTION 10 Alex wants to buy a bike and cycle to school. He writes the following program to calculate how much will be left in his account after he has bought the bike.

In [1]:

```
def Account(Amount_in_Account, Price_of_Bike):
    Amount_left_in_Account = Amount_in_Account - Price_of_Bike
    return(Amount_left_in_Account)
```

Now, Alex writes another program which calls the above function and if the Amount_in_Account is greater than £100, the program reports that "the account is looking good"; if there is less than or equal to £100, the program reports that "Your funds are running low " and if there is less than £0.00 then the program reports that " You have run out of money". Study Alex's program and correct it.

In []:

```
def Status():
    X= Account(200,2)
    if X < 102:
        print("The account is looking good")
    elif X <= 100:
        prin("Your funds are running low")
    elif X <0:
        prin("You have run out of money")
    else:
        print("Invalid Amount")
```

ANSWER 10 The errors

(i) Line 3, if X < 102 should read if X > 100 and this is an example of a logic error </br> (ii) Line 8, prin("You have run out of money") should read print("You have run out of money") and this is an example of a syntax error

In []:

```
def Status():
    X= Account(200,2)
    if X >= 100: # Instead of X < 102. A logic error.
        print("The account is looking good")
    elif X >=2 AND X <= 100: # Instead of X <=100. A logic error.
        print("Your funds are running low") # print instead of prin. A Syntax Error
    elif X <0:
        print("You have run out of money") # print instead of prin. A Syntax Error
    else:
        print("Invalid Entry")
```


