2.2 Programming - 2

Wednesday, 16 December 2020 7:21 PM

2.2 Programm...

Computer Science 2210
Topical Past Papers

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Topic: 2.2 Programming

Oct/Nov 2006

9 A computer program is required which inputs 10 numbers, multiplies them together and finally outputs the answer (the product). The following algorithm has been written to do this.

```
1 count = 0
2 product = 0
3 while count <= 10 do
4   input number
5   product = product * number
6   count = count + 1
7   print product
8 endwhile
```

(a) There are three errors in the algorithm. Locate and describe these errors. [3]
(b) A while ... do loop has been used in the algorithm. State another type of loop that could have been used. [1]

May/June 2010. P11
12 A golf course charges $10 for each game of two people. Each additional person incurs afurther charge of $2 per game. If they book two or more games in advance, they get a 10%discount on the total charge.
The following program has been written in pseudocode to calculate the charges for a game.

```
1 extracost = 0
2 input numberpeople, numbergames
3 charge = 10 * numbergames
4 extrapeople = numberpeople - 2
5 if numberpeople< 2 then extracost = 2 * extrapeople * numbergames
6 charge = extracost
7 if numbergames> 1 then charge = charge * 0.1
8 print charge
```

There are three errors in the program. Locate these errors and suggest a correct piece ofcoding. [6]

Oct/Nov 2010. P11

9 The following algorithm inputs 20 numbers and outputs how many numbers were positive (> 0) and how many numbers were negative (< 0).

```
1 negative = 1
2 positive = 1
3 for count = 1 to 20 do
4   input number
5   if number < 0 then negative = negative + 1
6   if number > 0 then positive = positive + 1
7   count = count + 1
8   print negative, positive
```

```
9 next count
```

There are three different errors in this algorithm.
Locate each error and give the reason why you think it is an error. [6]

May/June 2011 P12

7 (a) Read the following section of code that inputstwenty (20) numbers and then outputs the largestnumber input.

```
1 h = 0
2 c = 0
3 REPEAT
4 READ x
5  IF x > h THEN x = h
6 c = c + 1
7 PRINT h
8 UNTIL c < 20
```

There are THREE errors in this code.
Locate these errors and suggest a corrected pieceof code. [3]

Oct/Nov 2013. P12

8 A piece of pseudocode was written to input 1000 positive numbers and then output thehighest and lowest numbers.

```
10 highest = 0
20 lowest = 0
30 for count = 1 to 100
40   input number
50   if number > highest then number = highest
60   if number < lowest then number = lowest
70   count = count + 1
80 next count
90 print highest, lowest
```

There are errors in the code.
Locate these errors and suggest a correction. [8]

May/June 2014 P12

5 The following algorithm should:
- input ten numbers
- output the largest number input
- output the average value of the input data

```
10 largest = 0
20 sum = 0
30 for x = 1 to 10
40 input x
```

```
50 if x > largest then x = largest
60 output largest
70 sum = sum + x
80 next x
90 average = sum * 10
100 output average
```

There are four errors in this algorithm.
Locate these errors and suggest a correction.

Topic: 2.2 Programming

Array

Question 01: Input and store the names and marks for 30 students who have sat three computer science tests.Test 1 is out of 20 marks, Test 2 is out of 25 marks, Test 3 is out of 35 marks. You must store thenames in a one-dimensional array and the marks and total score for each student in one-dimensionalarrays. All the marks must be validated on entry and any invalid marks rejected. You may assumethat the students' names are unique.

Question 02: Calculate and store the total score for each student and calculate the average score for the wholeclass. Output each student's name followed by their total score, then output the average score for theclass.

Question 03: Select the student with the highest score and output their name and score.
Your program must include appropriate prompts for the entry of data. Error messages and otheroutput need to be set out clearly and understandably. All variables, constants and other identifiersmust have meaningful names. Each task must be fully tested.

Question 04: Write a pseudocode using array, asks user to input 10 numbers, then calculates the average of those numbers. Loop is used in this problem.

Question 05: Write a pseudocode to swap first and last element of an integer 1-d array.

Question 06: Write a pseudocodeto find the largest and smallest element of an array.

Topic: 2.2 Programming

Practice Questions:
Questions 1 to 3 contain sections of pseudocode which contain errors. Locate the errors and suggest the correct coding. Questions 4 to 10 are problems which require an algorithm to be written in pseudocode – there is "no right answer" here; as long as the pseudocode works then the solution is acceptable.

(1) The following section of pseudocode inputs 1000 numbers and then outputs how many were negative, how many were positive and how many were zero.
Locate the 3 errors and suggest a corrected piece of code.

```
1 negative ← 1: positive ← 1
2 for x ← 0 to 1000
3     input number
4     if number < 0 then negative ←negative + 1
5     if number > 0 then positive ←positive + 1
6     endif
7     endif
8 next
9 print negative, positive
```

(2) The following section of pseudocode inputs rainfall (in cm) for 500 days and outputs the average rainfall and the highest rainfall input.
Locate the 3 errors and suggest a corrected piece of code.

```
1 highest ← 1000
2 days ← 1
3 while days > 0
4     input rainfall
5     if rainfall > highest then highest ← rainfall
6     endif
7     total ←total + rainfall
8     days ←days + 1
9     average ← total/500
10 endwhile
11 print average, highest
```

(3) The following section of pseudocode inputs a number, n, multiplies together 1 x 2 x 3 x ..... x n, calculates input number/sum and outputs result of the calculation.
Locate the 3 errors and suggest a corrected piece of code.

```
1 input n
2 for mult← 1 to n
3     sum ← 0
4     sum ←sum * mult
5     result ← n/sum
6 next
7 print result
```

(4) Regis lives in Brazil and often travels to USA, Europe and Japan. He wants to be able to convert Brazilian Reais into US dollars, European euros and Japanese yen. The conversion formula is:

currency value = number of Reais X conversion rate
For example, if Regis is going to USA and wants to take 1000 Reais (and the exchange rate is 0.48) then he would input USA, 1000 and 0.48 and the output would be: 480 US dollars.

Write an algorithm, using pseudocode, which inputs the country he is visiting, the exchange rate and the amount in Brazilian Reais he is taking. The output will be value in foreign currency and the name of the currency.

(5) As part of an experiment, a school measured the heights (in metres) of all its 500 students.
Write an algorithm, using pseudocode, which inputs the heights of all 500 students and outputs the height of the tallest person and the shortest person in the school.

(6) A geography class decide to measure daily temperatures and hours of sunshine per day over a 12 month period (365 days)

Write an algorithm, using pseudocode, which inputs the temperatures and hours of sunshine for all 365 days, and finally outputs the average (mean) temperature for the year and the average (mean) number of hours per day over the year.

(7) A small shop sells 280 different items. Each item is identified by a 3 – digit code. All items that start with a zero (0) are cards, all items that start with a one (1) are sweets, all items that start with a two (2) are stationery and all items that start with a three (3) are toys.

Write an algorithm, using pseudocode, which inputs the 3 – digit code for all 280 items and outputs the number of cards, sweets, stationery and toys.

(8) A company are carrying out a survey by observing traffic at a road junction. Each time a car, bus, lorry or other vehicle passed by the road junction it was noted down.
10 000 vehicles were counted during the survey.
Write an algorithm, using pseudocode, which:

- inputs all 10000 responses
- outputs the number of cars, buses and lorries that passed by the junction during the survey
- outputs the number of vehicles that ***weren't*** cars, buses or lorries during the survey

Topic: 2.2 Programming

(9) Speed cameras read the time a vehicle passes a point (A) on the road and then reads the time it passes a second point (B) on the same road (points A and B are 100 metres apart). The speed of the vehicle is calculated using:

The maximum allowed speed is 100 kilometres per hour. 500 vehicles were monitored using these cameras over a 1 hour period.
Write an algorithm, using pseudocode, which:

- inputs the start time and end time for the 500 vehicles that were monitored
- calculate the speed for each vehicle using the formula above
- outputs the speed for each vehicle and also a message if the speed exceeded 100 km/hour
- output the highest speed of all the 500 vehicles monitored

(10)

$$speed = \frac{100}{(\text{time at point B} - \text{time at point A})} \ (meters/second)$$

The maximum allowed speed is 100 kilometres per hour. 500 vehicles were monitored using these cameras over a 1 hour period.

Write an algorithm, using pseudocode, which:

- inputs the start time and end time for the 500 vehicles that were monitored
- calculate the speed for each vehicle using the formula above
- outputs the speed for each vehicle and also a message if the speed exceeded 100 km/hour
- output the highest speed of all the 500 vehicles monitored

(10) There are ten stations on a railway line:

1 —— 2 —— 3 —— 4 —— 5 —— 6 —— 7 —— 8 —— 9 —— 10

The train travels in both directions (i.e. from 1 to 10 and then from 10 to 1). The fare between each station is $2.

A passenger inputs the number of the station at the start of his journey and the number of the destination station and the fare is calculated (e.g if a passenger gets on a station 3 and his destination is station 9 his fare will be $12). The calculation must take into account the direction of the train (e.g. a passenger getting on at station 7 and getting off at station 1 will also pay $12 and not a negative value!!).
A discount of 10% is given if 3 or more passengers are travelling together.
Write an algorithm, using pseudocode, which:

- inputs the number of passengers travelling
- inputs the station number of the starting point and the station number of the destination
- calculates the total fare taking into account the direction of travel
- calculates any discount due
- outputs the cost of the tickets and prints the tickets


```
ID←0, Count←0, W←0,
H←0, BMI←0
For Count = 1 to 30
    INPUT ID, W, H
    BMI← W/(H*H)
    OUTPUT ID, BMI
    IF BMI>25 THEN OUTPUT "OVERWEIGHT"
    IF BMI<19 THEN OUTPUT "UNDERWEIGHT"
    IF BMI >=19 AND BMI <=25 THEN OUTPUT "NORMAL"
NEXT
```

Computer Science 2210
Topical Past Papers

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Topic: 2.2 Programming

Past Papers Questions:
May/June 2006
16 (a) A formula for calculating the body mass index (BMI) is:

BMI ← W/(H*H)

$$\frac{80}{2*2} = \frac{80}{4} = 20 \qquad \text{BMI} = \frac{\text{weight in kilograms}}{(\text{height in metres}) \times (\text{height in metres})}$$

Calculate the BMI for a person whose weight is 80kg and height is 2 metres. [1]

(b) Using pseudocode or otherwise, write an algorithm that will input the ID, weight (kg) and height (m) of 30 students, calculate their body mass index (BMI) and output their ID, BMI and a comment as follows:

A BMI greater than 25 will get the comment 'OVER WEIGHT', a BMI between 25 and 19 (inclusive) will get 'NORMAL' and a BMI less than 19 will get 'UNDER WEIGHT'. [6]

20 Temperatures (°C) are being collected in an experiment every hour over a 200 hour period.
Write an algorithm, using pseudocode or otherwise, which inputs each temperature and outputs

- how many of the temperatures were above 20°C
- how many of the temperatures were below 10°C
- the lowest temperature that was input

[5]

```
Format 1
Initialisation
For Count ← 1 TO n
    INPUT ...
    Formula Calculation
    OUTPUT Formula Result

    Totalling (Total ← Total + ...)
    Counting with decision (c1)
    Output with decision.

    Extreme values

Next Count
Avg ← Total/n
Per ← (c1/n) * 100
OUTPUT ...
```

```
Count←0, Temp←0, a←0,
```

20 Temperatures (°C) are being collected in an experiment every hour over a 200 hour period. Write an algorithm, using pseudocode or otherwise, which inputs each temperature and outputs

- how many of the temperatures were above 20°C
- how many of the temperatures were below 10°C
- the lowest temperature that was input [5]

Per ← (a2/n) * 100
OUTPUT ...

Count ← 0, Temp ← 0, a ← 0, b ← 0, Low ← 1000
For Count ← 1 to 200
  INPUT Temp
  IF Temp > 20 THEN a ← a + 1
  IF Temp < 10 THEN b ← b + 1
  IF Temp < Low THEN Low ← Temp
Next Count
OUTPUT a, b, Low

May/June 2007

19 A company has 5000 CDs, DVDs, videos and books in stock. Each item has a unique5-digit code with the first digit identifying the type of item, i.e.

1 = CD
2 = DVD
3 = video
4 = book

For example, for the code 15642 the 1 identifies that it is a CD, and for the code 30055 the3 identifies that it is a video.
Write an algorithm, using pseudocode or otherwise, that

- Inputs the codes for all 5000 items
- Validates the input code
- Calculates how many CDs, DVDs, videos and books are in stock
- Outputs the four totals. [5]

Count ← 0, Code ← 0, x ← 0, CD ← 0, DVD ← 0, Video ← 0, Book ← 0
For Count ← 1 To 5000
  INPUT Code
  x ← INT(Code/10000)
  IF x = 1 THEN CD ← CD + 1
  IF x = 2 THEN DVD ← DVD + 1
  IF x = 3 THEN Video ← Video + 1
  IF x = 4 THEN Book ← Book + 1
Next
OUTPUT CD, DVD, Video, Book

INT( ) Function use:
Digit(s) extraction
3589 / 1000 = 3.589
x = INT(3.569) = 3.

Functions:
INT( )
It converts a real number to its integer/whole number form.
a = 3.56
x = INT(a) = 3
b = 4.99
n = INT(b) = 4

Topic: 2.2 Programming

Oct/Nov 2007

16 (a) Fuel economy for a car is found using the formula:

$$\text{Fuel Economy} = \frac{\text{Distance Travelled (km)}}{\text{Fuel Used (litres)}}$$

What would be the Fuel Economy of a car travelling 40 km on 10 litres of fuel? [1]

Count ← 0, DT ← 0, Fuel ← 0, FE ← 0
Highest ← -1000, Lowest ← 1000, Total ← 0, Avg ← 0
For Count ← 1 To 1000
  INPUT DT, Fuel
  FE ← DT / Fuel
  OUTPUT FE
  Total ← Total + FE
  IF FE > Highest THEN Highest ← FE
  IF FE < Lowest THEN Lowest ← FE
Next Count
Avg ← Total / 1000
OUTPUT Avg, Highest, Lowest

(b) The Fuel Economy for 1000 cars is to be calculated using the formula in Question 16(a). Write an algorithm, using pseudocode or otherwise, which inputs the Distance Travelled (km) and the Fuel Used (litres) for 1000 cars. The Fuel Economy for each car is then calculated and the following outputs produced:

- Fuel Economy for each car
- average (mean) Fuel Economy for all of the cars input
- the best Fuel Economy (i.e. highest value)
- the worst Fuel Economy (i.e. lowest value) [6]

Double Digit extraction:
n = INT(6532987 / 100000) = 65
6532987 / 100000 = 65.32987
= 65
b = 6532987
n = INT(b/100000)

May/June 2008

12 Algorithms and programs use loops to control the number of times a particular procedure isused.
Two methods are repeat ... until and for ... to.
(a) Write a procedure using both these loop methods to input 20 numbers into a variablecalled x.
(i) repeat ... until [2]
(ii) for ... to [2]
(b) Name another loop structure. [1]

x = 3432127920
INT(3432127920 / 10000000)
=> 343

19 Customers can withdraw cash from an Automatic Teller Machine (ATM).

- withdrawal is refused if amount entered > current balance
- withdrawal is refused if amount entered > daily limit
- if current balance < $100, then a charge of 2% is made
- if current balance $100, no charge is made

Write an algorithm which inputs a request for a sum of money, decides if a withdrawal can be made and calculates any charges. Appropriate output messages should be included. [5]

For digit extractions you are given:
1) How many digits to extract
2) Number of digits in number.

2) Number of digits ...
number.

Topic: 2.2 Programming

Oct/Nov 2008
19 The manufacturing cost of producing an item depends on its complexity. A company manufactures three different types of item, with costs based on the following calculations:

```
Item type 1: item cost = parts cost * 1.5
Item type 2: item cost = parts cost * 2.5
Item type 3: item cost = parts cost * 5.0
```

The company makes 1000 items per day.

Write an algorithm, using pseudocode, flowchart or otherwise, which
- inputs the item type and parts cost of each item
- outputs the item cost for each item
- calculates and outputs the average (mean) item cost per day (based on 1000 items being made). [5]

Format 1
Initialisation
✓ For Count ← 1 TO n
✓ INPUT ...
✗ Formula Calculation
✗ OUTPUT Formula Result
✗ Totalling (Total ← Total + ...)
✓ Counting with decision (c1)
✗ OUTPUT with decision.
✗ Extreme values
✓ Next Count
✗ Avg ← Total/n
✓ Per ← (c1/n) * 100
OUTPUT ...

May/June 2009
18 A small airport handles 400 flights per day from three airlines:
FASTAIR (code FA)
SWIFTJET (code SJ)
KNIGHTAIR (code KA)
Each flight is identified by the airline code and 3 digits. For example FA156
Write an algorithm, using pseudocode or otherwise, which monitors the 400 flights into and out of the airport each day. The following inputs, processing and outputs are all part of the monitoring process:
- input flight identification
- calculate number of flights per day for each of the three airlines
- output the percentage of the total flights per day by each airline
- ~~any validation checks must be included~~ [5]

FA 356
FA 125

Count ← 0, FC ← "", F ← 0, S ← 0, K ← 0, PFA ← 0, PSJ ← 0, PKA ← 0.
For Count ← 1 to 400
INPUT FC
IF FC ← "FA" THEN F ← F+1
IF FC ← "SJ" THEN S ← S+1
IF FC ← "KA" THEN K ← K+1
Next Count
PFA ← (F/400) * 100 | PFA ← F/4
PSJ ← (S/400) * 100 | PSJ ← S/4
PKA ← (K/400) * 100 | PKA ← K/4
OUTPUT PFA, PSJ, PKA.

Oct/Nov 2009. P11
17 (a) A car's speed is measured between points A and B, which are 200 km apart.

The final speed of the car is calculated using the formula:

$$\text{Final Speed} = \frac{200}{\text{Time (hours)}}$$

INPUT
Unknown

What is the final speed of a car if it takes 2 hours to get from A to B? [1]

Topic: 2.2 Programming

(b) Write an algorithm, using pseudocode or otherwise, which inputs the times for 500 cars, calculates the final speed of each car using the formula in part (a), and then outputs:
- the final speed for ALL 500 cars
- the slowest (lowest) final speed
- the fastest (highest) final speed
- the average final speed for all the cars. [6]

Count ← 0, Time ← 0, FS ← 0, Total ← 0, fastest ← -1000, slowest ← 1000, Avg ← 0
For Count ← 1 TO 500
INPUT Time
FS ← 200/Time
OUTPUT FS
Total ← Total + FS
IF FS > fastest THEN fastest ← FS
IF FS < slowest THEN slowest ← FS
Next count
Avg ← Total / 500
OUTPUT slowest, fastest, Avg.

May/June 2010. P11
18 A group of students were monitoring the temperature every day over a one year period.

- the tastest (highest) final speed
- the average final speed for all the cars. [6]

May/June 2010. P11

18 A group of students were monitoring the temperature every day over a one-year period. Readings were taken ten times every day (you may assume a year contains 365 days).

Write an algorithm, using pseudocode or flowchart, which

- inputs all the temperatures (ten per day)
- outputs the highest temperature taken over the year
- outputs the lowest temperature taken over the year
- outputs the average temperature per day
- outputs the average temperature for the whole year [7]

May/June 2010. P12

16 (a) Write an algorithm, using pseudocode or a flowchart, which:

- inputs 50 numbers
- outputs how many of the numbers were > 100 [3]

(b) Write an algorithm, using pseudocode or a flowchart, which:

- inputs 100 numbers
- finds the average of the input numbers
- outputs the average [3]

Oct/Nov 2010. P12

17 A school is doing a check on the heights and weights of all its students. The school has 1000 students.

Write an algorithm, using pseudocode or a flowchart, which

- inputs the height and weight of all 1000 students
- outputs the average (mean) height and weight
- includes any necessary error traps for the input of height and weight [5]

Oct/Nov 2010. P13

17 (a) Write an algorithm, using pseudocode or a flowchart, which

- inputs a set of positive numbers (which end with -1)
- outputs the average (mean) value of the input numbers
- outputs the value of the largest (highest) number input [4]

(b) Write an algorithm, using pseudocode or a flowchart, which

- inputs a whole number (which is > 0)
- calculates the number of digits in the number
- outputs the number of digits and the original number (E.g. 147 would give output of 3, 147) [4]

Topic: 2.2 Programming

May/June 2011. P11

17 Daniel lives in Italy and travels to Mexico, India and New Zealand. The times differences are:

Country	Hours	Minutes
Mexico	-7	0
India	+4	+30
New Zealand	+11	0

Thus, if it is 10:15 in Italy it will be 14:45 in India.

(a) Write an algorithm, using pseudocode or otherwise, which:
- Inputs the name of the country
- Inputs the time in Italy in hours (H) and minutes (M)
- Calculates the time in the country input using the data from the table
- Outputs the country and the time in hours and minutes [4]

(b) Describe, with examples, two sets of test data you would use to test your algorithm. [2]

May/June 2011. P12

17 A school has 1800 students. The start date and leaving date for each student is stored on file. Dates are in the format YYMMDD (e.g. a student starting on 10th September 2007 and leaving on 4th August 2012 has the data 070910 and 120804 on file).

(a) Write an algorithm, using pseudocode or otherwise, which
- inputs Student ID for all 1800 students
- inputs the start date and leaving date for each student
- carries out a check to ensure the second date is later
- if error, increments error counter
- outputs the number of errors

Count←0, ID←0, SD←0, LD←0,
Err←0
For Count ← 1 To 1800
INPUT ID, SD, LD
IF SD>LD THEN Err← Err+1
Next Count
OUTPUT Err [5]

(b) Describe, with examples, TWO sets of test data you would use to test your algorithm. [2]

Count←0, Num←0,
Highest← -1000.
For Count←1 To 3
Input Num
IF Num > Highest Then
Highest←Num
Next
OUTPUT Highest

Oct/Nov 2011. P11

17 (a) Write an algorithm, using pseudocode or flowchart only, which:
- inputs three numbers
- outputs the largest of the three numbers

(b) Write an algorithm, using pseudocode or flowchart only, which:
- inputs 1000 numbers
- outputs how many of these numbers were whole numbers (integers)

(You may use INT(X) in your answer e.g. Y = INT(3.8) gives the value Y = 3)

count←0, a←0, b←0
For Count ← 1 To 1000
INPUT a
b= INT(a)
IF a=b THEN n←n+1
Next Count
OUTPUT n

a=5
b=INT(a)
If a=b

Another Purpose of INT() Function.
To find whole number.

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Topic: 2.2 Programming

Oct/Nov 2011. P13

16 The weather conditions in a town are being monitored over a year (365 days). The valuesrecorded per day are weather type and temperature (e.g. CLOUDY, 25).
Write an algorithm, using pseudocode or flowchart only, which:
- inputs the weather type and temperature for each day
- outputs the number of days that were CLOUDY, RAINING, SUNNY or FOGGY
- outputs the highest recorded temperature for the year
- outputs the lowest recorded temperature for the year

May/June 2012. P11

17 Write an algorithm, using pseudocode or a program flowchart only, which:
- inputs the population and land area for 500 countries.
- calculates the population density (i.e. population/land area) for every country.
- outputs the largest and smallest population density.
- outputs the average population for all 500 countries. [6]

May/June 2012. P12

15 An estate agent advertises houses for sale. The customer enquiries for a 7-day workingweek are entered weekly into a computer.
Write an algorithm, using pseudocode or a program flowchart only, which:

Format 1
Initialisation
OR Count ← 1 To n
INPUT ...
Formula Calculation
OUTPUT Formula Result

Totalling (Total ← Total + ...)
Counting with decision (c1)
OUTPUT with decision.

Extreme Values
Next Count
Avg ← Total/n
Per ← (c1/n) * 100
OUTPUT ...

Count←0, WT←"", Temp←0,
C←0, S←0, R←0, F←0, Highest← -1000,
Lowest← 1000.
For Count ← 1 To 365
INPUT WT, Temp
IF WT = "CLOUDY" THEN C←C+1
IF WT = "SUNNY" THEN S←S+1
IF WT = "RAINING" THEN R←R+1
IF WT = "FOGGY" THEN F←F+1
IF Temp > Highest THEN Highest←Temp
IF Temp < Lowest THEN Lowest←Temp
Next
OUTPUT C, S, R, F, Highest, Lowest

✓ INPUT X
✓ a = INT(X)
IF X=a Then n←n+1

X	a	Is Whole No?	n
3.5	3	False	0
7	7	True	1
6.8	6	False	1
9	9	True	2

Count←0, n←0, x←0, w←0
For Count ← 1 To 1000
INPUT n
x← INT(n)
IF n=x Then w←w+1
Next
OUTPUT w

Count←0, POP←0, LA←0, PD←0,
Tot←0, Lar← -1000, Small← 1000,
For Count ← 1 to 500 Avge 0
INPUT POP, LA
PD← POP/LA
OUTPUT PD
Tot←Tot + POP
IF PD>Lar THEN Lar← PD

May/June 2012. P12

15 An estate agent advertises houses for sale. The customer enquiries for a 7-day workingweek are entered weekly into a computer.
Write an algorithm, using pseudocode or a program flowchart only, which:
- inputs the number of customer enquiries each day,
- inputs the house price each customer enquires about,
- outputs how many customers enquired each day about houses costing less than $100 000,
- outputs the percentage of all enquiries made during the week about houses costingmore than $500 000. [6]

Oct/Nov 2012. P12

17 (a) Write an algorithm, using pseudocode or a program flowchart only, that:
- inputs a series of positive numbers (-1 is used to terminate the input),
- outputs how many numbers were less than 1000 and
- outputs how many numbers were greater than 1000. [4]

(b) Write an algorithm, using pseudocode or a program flowchart only, that
- inputs fifty numbers each as 4 separate digits, for example: 1 5 4 1
- outputs the percentage of numbers that were palindromes.

(note: a palindrome reads the same way backwards or forwards. For example, 1331 isa palindrome but 1541 is not).
Use separate variables to store the separate digits of a number (for example D1, D2, D3, D4). [4]

Topic: 2.2 Programming

Oct/Nov 2012. P13

16 A small café sells five types of item:

bun 0.50 dollars
coffee 1.20 dollars
cake 1.50 dollars
sandwich 2.10 dollars
dessert 4.00 dollars

Write an algorithm, using pseudocode or a program flowchart only, which
- inputs every item sold during the day,
- uses an item called "end" to finish the day's input,
- adds up the daily amount taken for each type of item,
- outputs the total takings (for all items added together) at the end of the day,
- outputs the type of item that had the highest takings at the end of the day. [4]

May/June 2013. P11

2 Name two different types of loop structure in a typical programming language.
Give an example of how ten numbers could be input using the named loop. [6]

16 A small shop uses barcodes which represent 5 digits. The last digit is used as a check digit.
For example:

a	b	c	d	e
0	1	2	3	4

The check digit (e) is found by:
- multiplying the first and third digits (i.e. a and c) by 3
- multiplying the second and fourth digits (i.e. b and d) by 2
- adding these four results together to give a total
- dividing this total by 10
- remainder is check digit (e)

Write an algorithm, using pseudocode or flowchart only, which
- inputs 100 five-digit barcodes in the form a, b, c, d, e
- re-calculates the check digit for each number and checks whether the input check digit(e) is correct
- outputs the number of barcodes which were entered correctly [5]

May/June 2013. P12

17 A country has four mobile phone network operators. Each mobile phone number has eightdigits. The first three digits identify the network operator:
444 Yodafone
555 N2 network
666 Kofee mobile
777 Satsuma mobile
Write an algorithm, using pseudocode or flowchart only, which reads 50 000 eight-digitmobile phone calls made during the day and outputs the number of calls made on each ofthe four networks. [6]

Computer Science 2210
Topical Past Papers

Zak ZAFAR ALI KHAN

Topic: 2.2 Programming

Oct/Nov 2013. P12

16 (a) A greenhouse is being monitored by a computer using 2 sensors. SENSOR1 measuresthe temperature and SENSOR2 measures oxygen levels.
If the temperature exceeds 45°C or oxygen level fall below 0.19, then an errormessage is output by the computer.
Write an algorithm, using pseudocode or flowchart only, which
- inputs both sensor readings
- checks the sensor input values and outputs a warning message if either are out of range
- continues monitoring until the <ESCAPE> key is pressed

(You may assume that READ SENSORn will take a reading from SENSORn and that READ KEY inputs a key press from the keyboard). [5]

Oct/Nov 2013. P13

10 (a) The following pseudocode was written to input 1000 dates.

```
1 count = 1
2 repeat
3 input day, month, year
```

DIVISION
3 | 16 | 15 | 1
16 DIV 3 = 5
16 MOD 3 = 1
16/3 = 5.333 Absolute

Example:
937 pencils to pack in boxes
7 pencils per box
Q: How many full boxes (f)
How many left over pencil (l)
f ← 937 DIV 7 = 133
l ← 937 MOD 7 = 6

Count←0, a←0, b←0, c←0, y←0
d←0, e←0, n←0, m←0, x←0, c←0
FOR Count ← 1 to 500
INPUT a, b, c, d, e
n = (a×3) + (c×3)
m = (b×2) + (d×2)
x = n + m
y = x MOD 10
IF y = e THEN c←c+1
Next
OUTPUT c.

a b c d e → Check Digit
0 1 2 3 4
a = 0×3 = 0
b = 1×2 = 2
c = 2×3 = 6
d = 3×2 = 6
14
10 | 14 | 10 | 4 | 1

INT (44427289 / 100000) = 444

Count←0, Number←0, x←0,
Y←0, N←0, K←0, S←0
FOR Count ← 1 TO 50000
INPUT Number
x ← INT (Number / 100000)
IF x = 444 THEN Y←Y+1
IF x = 555 THEN N←N+1
IF x = 666 THEN K←K+1
IF x = 777 THEN S←S+1
Next Count
OUTPUT Y, N, K, S

SENSOR1←0, SENSOR2←0
KEY←FALSE
INPUT SENSOR1, SENSOR2, KEY
WHILE KEY <> TRUE
IF SENSOR1>45 OR SENSOR2<0.19 THEN
OUTPUT "Error"
INPUT SENSOR1, SENSOR2, KEY
ENDWHILE

SENSOR1←0, SENSOR2←0, KEY←FALSE
REPEAT
INPUT SENSOR1, SENSOR2, KEY
IF SENSOR1 >45 OR SENSOR2<0.19
THEN OUTPUT "Error"
UNTIL KEY = TRUE

10 (a) The following pseudocode was written to input 1000 dates.

```
1 count = 1
2 repeat
3 input day, month, year
4 count = count + 1
5 until count = 1000
```

(i) Describe why the loop only inputs 999 dates instead of 1000. [1]

(ii) What needs to be changed or added to the above code to make sure 1000 dates are input? [1]

(b) Errors in code can be found using test data.
Name three different types of test data. Using month from the pseudocode above, give an example of each type of test data. [6]

15 5000 numbers are being input which should have either 1 digit (e.g. 5), 2 digits (e.g. 36), 3digits (e.g. 149) or 4 digits (e.g. 8567).
Write an algorithm, using pseudocode or flowchart only, which

- inputs 5000 numbers
- outputs how many numbers had 1 digit, 2 digits, 3 digits and 4 digits
- outputs the % of numbers input which were outside the range [6]

May/June 2014. P11

15 A survey is being carried out which involves reading and recording sound levels near a busy roadjunction. Once all the data are collected, they are input manually into a computer. A sound levelof 0 decibels (0 dB) is input to indicate the end of the data.
Write an algorithm, using pseudocode or a flowchart, which:

- inputs all the sound levels
- after a sound level of 0 is input, outputs the following:
  - o average sound level
  - o highest recorded sound level.


```
INPUT SENSOR1, SENSOR2, KEY
IF SENSOR1 >45 OR SENSOR2 <19
THEN OUTPUT "Error"
UNTIL KEY = TRUE
```

```
Count←0, Num←0, X←0,
A←0, B←0, C←0, D←0, E←0,
Pev←0
FOR Count ← 1 TO 5000
    INPUT Num
    X ← INT(LOG(Num))+1
    IF X=1 THEN A←A+1
    IF X=2 THEN B←B+1
    IF X=3 THEN C←C+1
    IF X=4 THEN D←D+1
    IF X>4 THEN E←E+1
NEXT
Pev ← (E/5000) *100
OUTPUT A, B, C, D, Pev
```

Topic: 2.2 Programming

May/June 2014 P12

18 A school has 1500 students. It is conducting a survey on their music preferences. Each student uses a computer and inputs their name and then chooses one of 5 options:

- rock (input value 1)
- soul (input value 2)
- pop (input value 3)
- jazz (input value 4)
- classical (input value 5)

Write an algorithm, using pseudocode or a flowchart, which:

- inputs the choice of all 1500 students (values 1 to 5)
- outputs all the names of the students who chose classical music
- outputs the percentage who chose each option

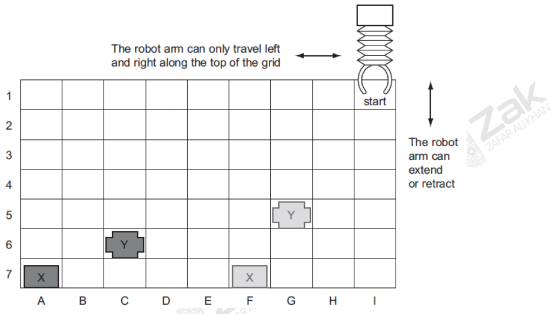
```
Count ← 0, StuName ← "", Choice ← 0,
R ← 0, S ← 0, P ← 0, J ← 0, C ← 0
PR ← 0, PS ← 0, PP ← 0, PJ ← 0, PC ← 0
FOR Count ← 1 TO 1500
    INPUT StuName, Choice
    IF Choice = 1 THEN R ← R + 1
    IF Choice = 2 THEN S ← S + 1
    IF Choice = 3 THEN P ← P + 1
    IF Choice = 4 THEN J ← J + 1
    IF Choice = 5 THEN C ← C + 1
    IF Choice = 5 THEN OUTPUT StuName
NEXT Count
PR ← (R / 1500) * 100
PS ← S / 15
PP ← P / 15
PJ ← J / 15
PC ← C / 15
OUTPUT PR, PS, PP, PJ, PC
```

IF Choice = 5 THEN
C ← C + 1
OUTPUT StuName
ENDIF

Oct/Nov 2006 P1

10 A robot arm is to be used to move some objects which are positioned on the grid shown. Object "X" is located at A7 and is to be moved to F7. Object "Y" is located at C6 and is to bemoved to G5.

The START position for the robot arm is shown. The robot arm can travel left and right alongthe top of the grid, and the robot arm can extend (lengthen) and retract (shorten) so that thegripper at the end of the arm can reach any grid square.



The following commands must be used:

Instructions for Robot Arm	
Right *n*	Moves *n* squares to the right
Left *n*	Moves *n* squares to the left

Instructions for Robot Arm	
Down *n*	Moves *n* squares down (extend)
Up *n*	Moves *n* squares up (retract)
Close	Closes the gripper
Open	Opens the gripper

For example, to move block "X" from square A7 to F7 (beginning at START) would require the following instructions:

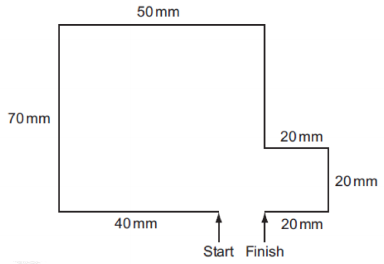
```
Left 8
Down 6
Close
Up 6
Right 5
Down 6
Open
```

Write a set of instructions to transfer block "Y" from C6 to G5 (beginning at START). [3]

May/June 2008 P1

7 A floor turtle can use the following instructions:

Instruction	Meaning
FORWARD ***n***	Move ***n*** mm forward
BACKWARD ***n***	Move ***n*** mm backward
LEFT ***d***	Turn left ***d*** degrees
RIGHT ***d***	Turn right ***d*** degrees
PENUP	Lift the pen
PENDOWN	Lower the pen
REPEAT ***n***	Repeat the following instructions *n* times
ENDREPEAT	Finish the REPEAT loop



Complete the set of instructions to draw the above shape.

PENDOWN .....
LEFT 90 .....
FORWARD ....
....
....
....
....
....
.... [4]

Oct/Nov 2008 P1

3 Write a routine using a for … to loop which inputs 100 numbers and outputs how many of the numbers were negative. [3]

May/June 2010 P11

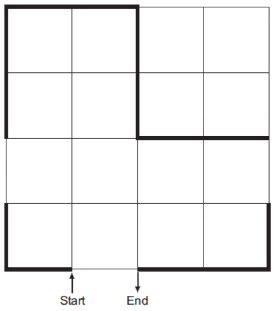
(c) What is meant by top-down design when developing new software?

May/June 2010 P12

15 A floor turtle can use the following instructions:

Instruction	Meaning
FORWARD ***d***	Move ***d*** cm forward
BACKWARD ***d***	Move ***d*** cm backward
LEFT ***t***	Turn left ***t*** degrees
RIGHT ***t***	Turn right ***t*** degrees
REPEAT ***n***	Repeat the next set of instructions ***n*** times
ENDREPEAT	End of REPEAT loop
PENUP	Raise the pen
PENDOWN	Lower the pen

(In the following grid, each square is 10 cm by 10 cm.)



Topic: 2.2 Programming

Complete the set of instructions to draw the shape (shown in bold lines) by filling in the blank lines.

LEFT 90

PENDOWN

FORWARD 10

RIGHT 90

.....

.....

.....

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[5]

Topic: 2.2 Programming

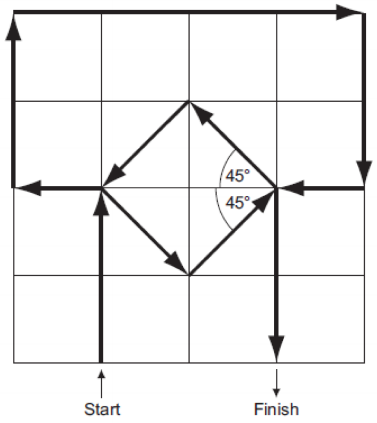
May/June 2012 P11

5 A floor turtle can use the following instructions.

Instruction	Meaning
FORWARD ***x***	Move ***x*** cm forwards
LEFT ***t***	Turn left ***t*** degrees
RIGHT ***t***	Turn right ***t*** degrees
REPEAT ***n***	Repeat next set of instructions ***n*** times
ENDREPEAT	Finish repeated instructions
PENUP	Lift the pen
PENDOWN	Lower the pen

Each square = 10 cm by 10 cm

Each diagonal line = 14 cm



Complete the set of instructions to draw the above shape in the direction shown by the arrows.

PENDOWN	.....	.....
FORWARD 20	.....	.....
LEFT 90	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....

[5]

Topic: 2.2 Programming

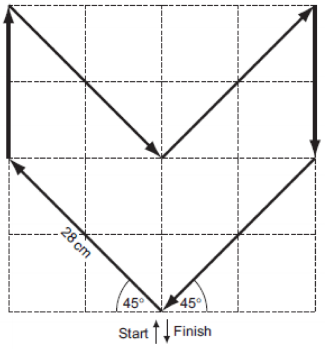
May/June 2014 P11

5 A floor turtle can use the following instructions.

Instruction	Meaning
FORWARD *x*	Move *x* cm forwards
BACKWARD *x*	Move *x* cm backwards
LEFT *t*	Turn left *t* degrees
RIGHT *t*	Turn right *t* degrees
REPEAT *n*	Repeat next set of instructions *n* times
ENDREPEAT	Finish repeated instructions
PENUP	Lift the pen
PENDOWN	Lower the pen

Each square is 10 cm by 10 cm

Each diagonal line is 28 cm long



Topic: 2.2 Programming

Complete the following set of instructions to draw the shape in the direction shown by the arrows.

PENDOWN
LEFT 45
1 .....
2 .....
3 .....
4 .....
5 .....
6 .....
7 .....
8 .....
9 .....
10 .....
11 .....
12 .....
13 .....
14 .....

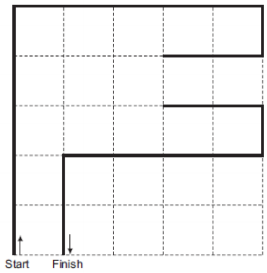
[5]

May/June 2014 P12

7 A floor turtle uses the following commands:

command	description
FORWARD ***n***	Move ***n*** cm in a forward direction
BACKWARD ***n***	Move ***n*** cm in a backward (reverse) direction
RIGHT ***t***	Turn right through ***t*** degrees
LEFT ***t***	Turn left through ***t*** degrees
PENUP	Lift the drawing pen up
PENDOWN	Lower the drawing pen
REPEAT ***x***	Repeat the next set of instructions ***x*** times
ENDREPEAT	Finish the REPEAT loop

In the following grid, each of the squares measures 10 cm by 10 cm:



Complete the set of instructions to draw the shape shown above (in bold lines).

```
1  PENDOWN
2  REPEAT 2
3  .....
4  .....
5  .....
6  .....
7  .....
8  .....
9  .....
10 .....
11 .....
12 .....
13 .....
14 .....
15 .....
16 .....
17 .....
18 .....
19 .....
20 .....
21 .....
22 .....
23 .....
24 .....
25 .....
26 .....
```

May/June 2015 P21 (2210)
Pre-release Material

Write and test a program to complete the **three** tasks.

TASK 1

A data logger records the temperature on the roof of a school twice a day, at midday and midnight. Input and store the temperatures recorded for a month. You must store the temperatures in two one-dimensional arrays, one for the midday temperatures and one for the midnight temperatures. All the temperatures must be validated on entry and any invalid temperatures rejected. You must decide your own validation rules. You may assume that there are 30 days in a month.

TASK 2

Calculate the average temperature for midday and the average temperature for midnight. Output these averages with a suitable message for each one.

TASK 3

Select the day with the highest midday temperature and the day with the lowest midnight temperature. Then output each of these temperatures, the corresponding day and a suitable message.

Your program must include appropriate prompts for the entry of data. Error messages and other outputs need to be set out clearly and understandably. All variables, constants and other identifiers must have meaningful names. Each task must be fully tested.

1 **(a)** All variables, constants and other identifiers should have meaningful names.

(i) In **Task 1**, you had to store the midday temperatures and midnight temperatures in arrays.

Write suitable declarations for these **two** arrays.

.....

.....[2]

(ii) It has been decided to record the temperatures for one week rather than one month.

Write the new array declarations that you would use.

.....

.....[1]

(iii) Declare **two** other variables that you have used and state what you used each one for.

Variable 1 .....

Use .....

Variable 2 .....

Use .....[4]

(b) Write an algorithm to complete **Task 2**, using **either** pseudocode, programming statements **or** a flowchart. Use temperatures for **one week** only. You should assume that Task 1 has already been completed.

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.....[5]

(c) Give a set of midday temperature data, for a week, that could be used to check your validation rules for **Task 1**. Explain why you chose this data set.

Data set .....

.....

Reason for choice.....

.....

.....[2]

(d) Explain how you select the day with the highest midday temperature (part of **Task 3**). You may include pseudocode or programming statements as part of your explanation.

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.....[6]

2 Read this section of program code that should input 10 positive numbers and then output the smallest number input.

```
1   Small = 0
2   Counter = 0
3   REPEAT
4     INPUT Num
5     IF Num < Small THEN Num = Small
6     Counter = Counter + 1
7     PRINT Small
8   UNTIL Counter < 10
```

There are **four** errors in this code.

Locate these errors and suggest a corrected piece of code for each error.

1 .....

.....

2 .....

.....

3 .....

.....

4 .....

.....[4]

4 Five data types and five data samples are shown below.

Draw a line to link each data type to the correct data sample.

Data type	Data sample
Integer	'a'
Real	2
Char	2.0
String	True
Boolean	"Twelve"

[4]

5 Explain the difference between a variable and a constant in a program.

.....

.....

.....

.....[2]

6 Identify **three** different loop structures that you can use when writing pseudocode.

1 .....

.....

2 .....

.....

3 .....

.....[3]

May/June 2015 P22 (2210)

Pre-release Material

Write and test a program to complete the **three** tasks.

TASK 1

A school keeps records of the weights of each pupil. The weight, in kilograms, of each pupil is recorded on the first day of term. Input and store the weights and names recorded for a class of 30 pupils. You must store the weights in a one-dimensional array and the names in another one-dimensional array. All the weights must be validated on entry and any invalid weights rejected. You must decide your own validation rules. You may assume that the pupils' names are unique. Output the names and weights of the pupils in the class.

TASK 2

The weight, in kilograms, of each pupil is recorded again on the last day of term. Calculate and store the difference in weight for each pupil.

TASK 3

For those pupils who have a difference in weight of more than 2.5 kilograms, output, with a suitable message, the pupil's name, the difference in weight and whether this is a rise or a fall.

Your program must include appropriate prompts for the entry of data. Error messages and other outputs need to be set out clearly and understandably. All variables, constants and other identifiers must have meaningful names. Each task must be fully tested.

Topic: 2.2 Programming

1 **(a)** All variables, constants and other identifiers should have meaningful names.

(i) Declare the array to store the pupils' names.

.....[1]

(ii) Declare the array to store the pupils' weights.

.....[1]

(iii) It has been decided to record the weights for the whole school of 600 pupils rather than one class.

Write suitable new declarations for these two arrays.

.....

.....[1]

(b) Write an algorithm to complete **Task 2**, using **either** pseudocode, programming statements **or** a flowchart. Use weights for **the whole school**. You should assume that Task 1 has already been completed.

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.....[5]

(c) **(i)** Describe suitable validation rules for **Task 1**.

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.....

.....

.....[2]

(ii) Give **two** pupil weights that you could use to check the validation used in **Task 1**. Explain why you chose each weight.

Weight 1 .....

Reason for choice .....

.....

Weight 2 .....

Reason for choice .....

.....[4]

(d) Explain how you select the pupils with a fall in weight of more than 2.5 kilograms (part of **Task 3**). You may include pseudocode or programming statements as part of your explanation.

.....

.....

.....

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.....

.....

.....

.....

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.....

.....[6]

2 Read this section of program code that should input 30 positive numbers and then output the largest number input.

```
1   Large = 9999
2   Counter = 0
3   WHILE Counter > 30
4   DO
5     INPUT Num
6     IF Num < Large THEN Large = Num
7     Counter = Counter - 1
8   ENDWHILE
9   PRINT Large
```

There are **four** errors in this code.

Locate these errors and suggest a corrected piece of code for each error.

1 .....

.....

2 .....

.....

3 .....

.....

4 .....

.....[4]

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