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UNIVERSITI TEKNOLOGI MALAYSIA
TEST 1 (WRITTEN)
SEMESTER 1, 2023/2024

SUBJECT CODE	:	**SECJ1013**
SUBJECT NAME	:	**PROGRAMMING TECHNIQUE I**
TIME	:	**2 HOURS (8:00PM - 10:00PM)**
DATE/DAY	:	**05 DECEMBER 2023 (TUESDAY)**
VENUES	:	**N28, BK1-7**

INSTRUCTIONS:

This test book consists of two parts:

PART A: PROBLEM-SOLVING (4 QUESTIONS)	(40 MARKS)
PART B: PROGRAMMING (4 QUESTIONS)	(60 MARKS)
TOTAL	**(100 MARKS)**

ANSWER ALL QUESTIONS IN THIS BOOKLET IN THE SPACES PROVIDED.

Additional answer sheets will be given upon request.

(Please Write Your Name, Lecturer Name and Section in Your Answer Booklet)

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This question paper consists of **18** printed pages excluding this page.

89.5

82.5 + 2

(82.5) + 1

83.5 ✓

PART A: PROBLEM-SOLVING QUESTIONS [40 MARKS]

QUESTION 1 [10 MARKS]

Identify the output of the flowchart in **Figure A1** by tracing the value of the variables. Complete the tracing table in **Table A1** to write your answers. Then, show the calculations for variable ***nd***, ***all*** and ***div*** in **Table A2**.

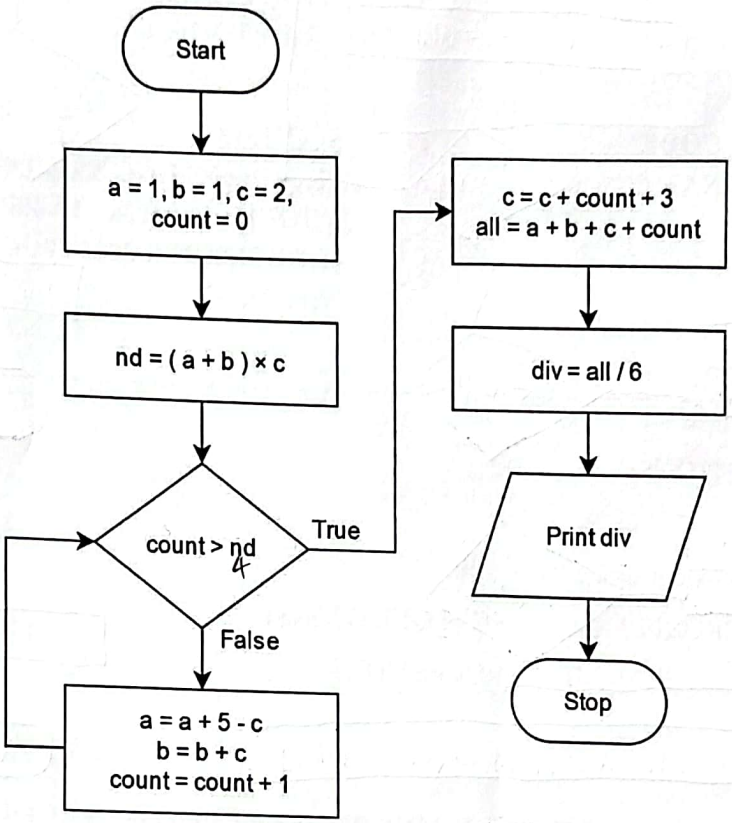


Figure A1: Flowchart for Question 1

Table A1: Tracing table

a	b	c	count	count > nd	Output
1	1	2	0	False	
4	3		1	False	
7	5		2	False	
10	7		3	False	
13	9		4	False	
16	11		5	True	
		10			div = 7

Table A2: Variables calculation for Question 1

Calculation for variable *nd*, *all* and *div*:

nd = (a+b)×c
= (1+1)×2
= 2×2
= 4

div = all/6
= 42/6
= 7

all = a+b+c+count
= 16+11+10+5
= 42

QUESTION 2 **[10 MARKS]**

Draw a **flowchart** to calculate the price of items after discount. The steps for calculating are as follows:

(a) Get the prices of items.

(b) If the total prices of the items are more than RM 50.00, call a user-defined function named *"disc10"* then calculate the total price after discount and return it to the main function.

(c) If the total prices of the items are more than RM 100.00, call a user-defined function name *"disc15"* then calculate the total price after discount and return it to the main function.

(d) Finally, in the main function, display the total number of items, the original total price before discount and the price after discount.

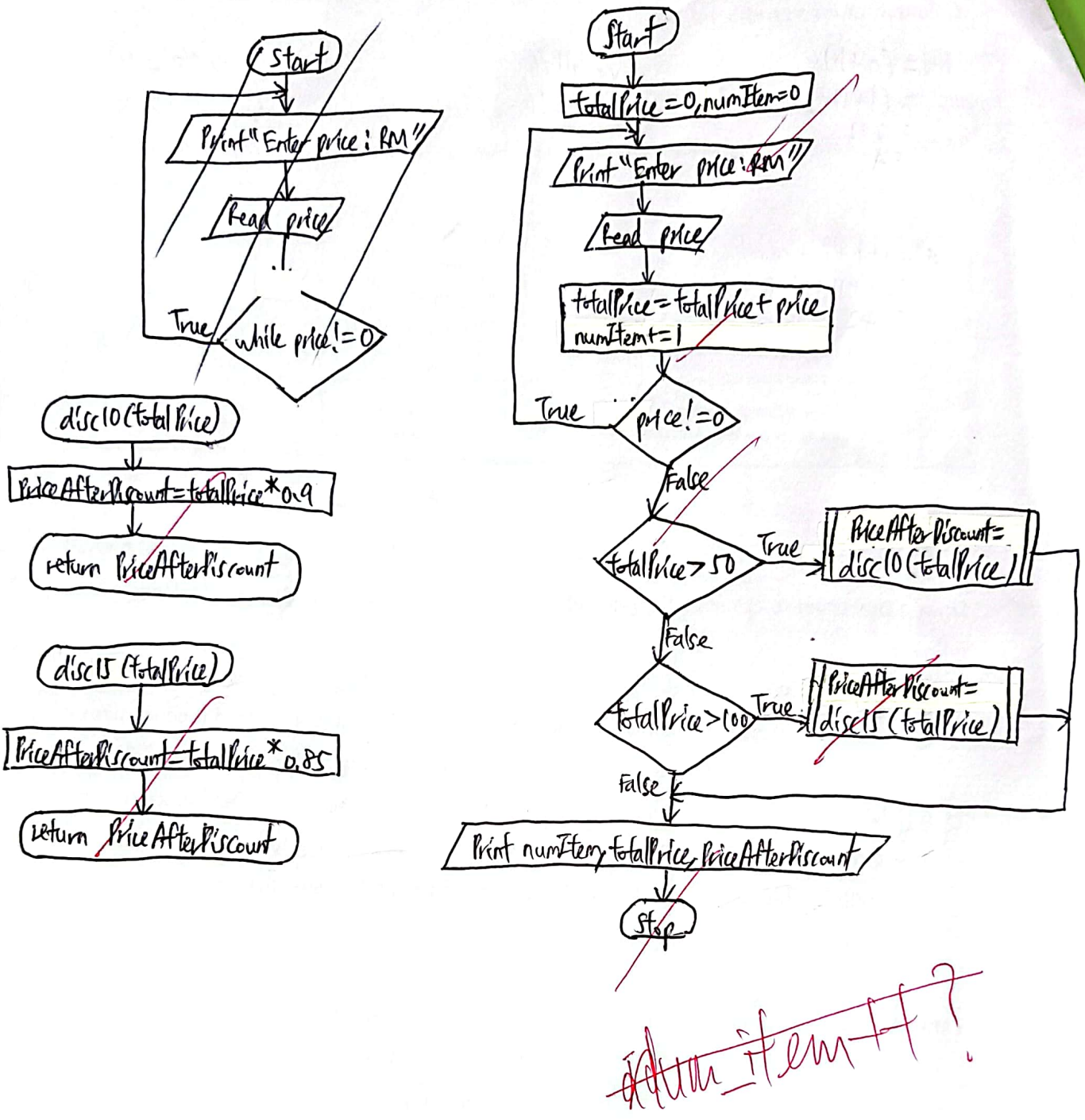
Table A3 shows the discount tag offer for the total price of the items.

Table A3: Discount for each tag for Question 2

Discount Tag	Discount
disc10	10%
disc15	15%

Note: User input in step (a), allows more than an item price to be added. Calculation of the total price after discount must be done in the user defined function as named in (b) and (c) accordingly. The price after discount must be returned to the main function once the calculation is finished.

Answer space for Question 2



return item++?

9 10

QUESTION 3 **[10 MARKS]**

Please complete the flow chart given in **Figure A2** so that it will produce any outputs given in the **example 1 to 3**. Write your answer in **Table A4**.

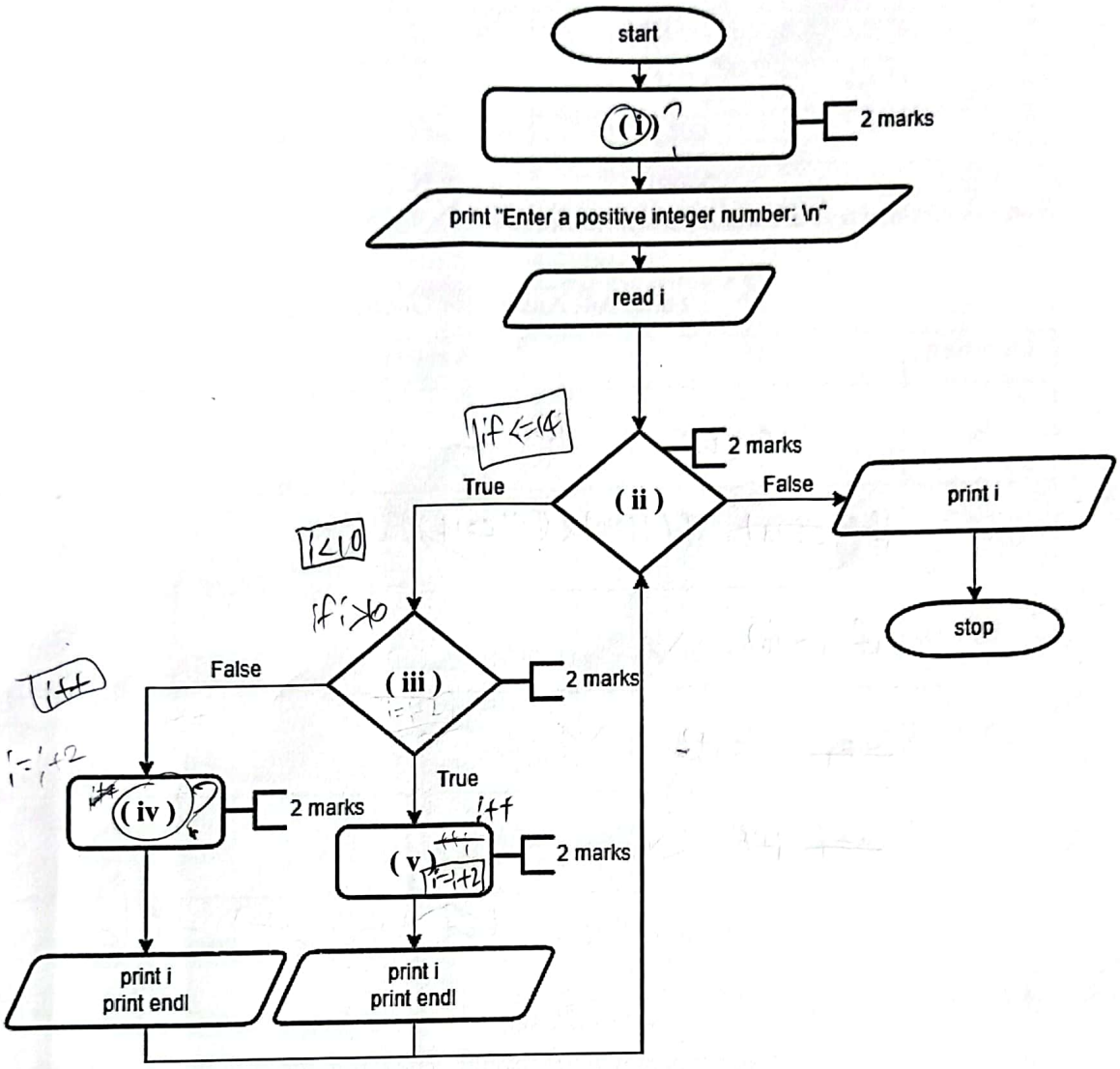


Figure A2: Flowchart for Question 3

Example output 1:

```
Enter a positive integer
number:
23 [Enter]
23
```

Example output 2:

```
Enter a positive integer
number:
14 [Enter]
15
15
```

Example output 3:

```
Enter a positive integer
number:
9 [Enter]
11
11
12
13
14
15
15
```

Note: the bolded text are the inputs from the user

Table A4: Answer for Question 3

Question	Answer
(i)	i=0
(ii)	if(i<=14) if((i>0)&&(i<=14))
(iii)	if(i>10)
(iv)	++i i!=i+2
(v)	++i iff

4 2+2+6

QUESTION 4 **[10 MARKS]**

Write a complete **pseudocode** which will get several inputs from the user: bank 'account balance', the 'account type' and 'account level' they have. Apply **selection** concept. Based on this information and the rate table from Bank ABC in **Table A5**, determine the interest rate they are receiving.

Table A5: Rate table of Bank ABC for Question 4

Type of Account	Level	Minimum Balance	Interest Rate
Student	Standard	RM25	1.3 %
Personal	Standard	RM0	1.2 %
Personal	Gold	RM1000	1.9 %
Personal	Gold	RM5000	2.3 %
Business	Standard	RM1500	1.7 %
Business	Platinum	RM10000	2.5%

Answer space for Question 4

```
1. Start
2. Print "Enter bank account balance : RM"
3. Read account_balance
4. Print "Enter account type : "
5. Read account_type
6. Print "Enter account level: "
7. Read account_level
8. If ( (account_type == "Student") && (account_level == "Standard") && (account_balance >= 25) )
     8.1 interest_rate = 0.013
9. Else if ( (account_type == "Personal") && (account_level == "Standard") && (account_balance >= 0) )
     9.1 interest_rate = 0.012
10. Else if ( (account_type == "Personal") && (account_level == "Gold") && (account_balance >= 1000) )
     10.1 interest_rate = 0.019
11. Else if ( (account_type == "Personal") && (account_level == "Gold") && (account_balance >= 5000) )
     11.1 interest_rate = 0.023
12. Else if ( (account_type == "Business") && (account_level == "Standard") && (account_balance >= 1500) )
     12.1 interest_rate = 0.017
13. Else if ( (account_type == "Business") && (account_level == "Platinum") && (account_balance >= 10000) )
     13.1 interest_rate = 0.025
14. Else
     14.1 interest_rate = 0
15. End if
16. If ( interest_rate == 0 )
     16.1 Print "Invalid"
17. Else
     17.1 Print "Interest Rate = ", interest_rate
18. End if
19. Stop
```

10

PART B: PROGRAMMING QUESTIONS [60 MARKS]

QUESTION 1 [15 MARKS]

(a) **Figure B1** shows the flowchart that asks the user to calculate the total mark of a test. The C++ code of the flowchart is shown in **Figure B2**. You are required to complete the C++ code in **Figure B2** and write your answer in **Table B1**. [5 marks]

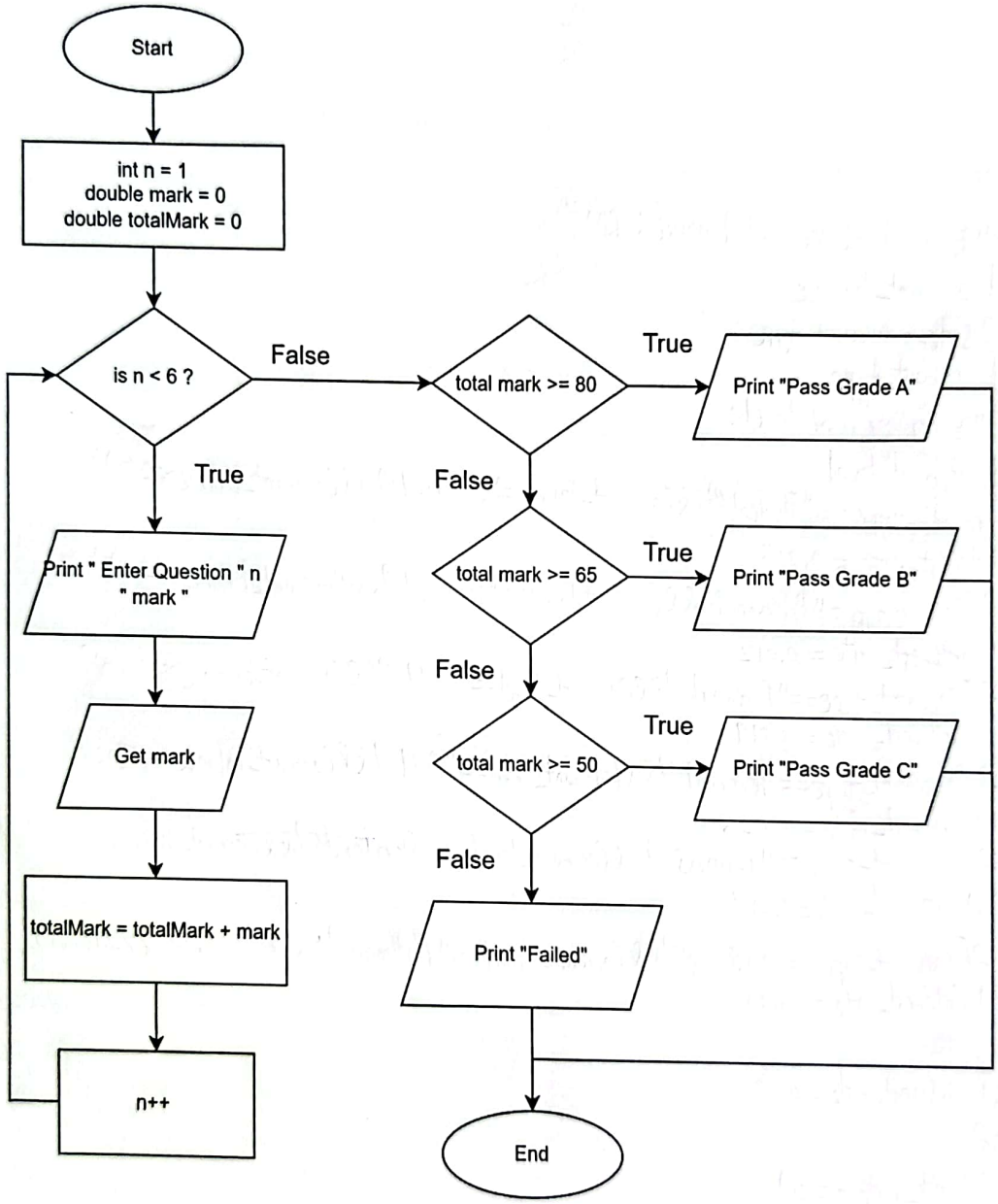


Figure B1: Flowchart for Question 1(a)

```
#include <iostream>
using namespace std;
int main() {

    int n = 1;
    double mark, totalMark = 0;

    _____(i)
    {
        cout << "Enter Question"<< n <<" mark ";
        cin >> mark;

        _____(ii)

        n++;
    }

    if(total_____(iii)_
        cout << "Pass Grade A";

    _____(iv)_____
        cout << "Pass Grade B";

    _____(v)_____
        cout << "Pass Grade C";

    else
        cout << "Failed";

    return 0;
}
```

Figure B2: C++ program code for Question 1(a)

Table B1: Answer for Question 1(a)

Question	Answer
(i)	while (n<6)
(ii)	totalmark= totalmark+mark;
(iii)	if(totalmark>=80)
(iv)	else if(totalmark>=65)
(v)	else if(totalmark>=50)

(b) From the C++ program code in **Figure B3**, trace the output and write your answer in the answer column. [5 marks]

Line	Code	Answer
1	`#include <iostream>`	
2	`using namespace std;`	
3	`int main(){`	
4	`int a, b = 2, c, d = 1, e=0;`	
5	`float p = 3.0, q=0.0;`	
6	`char x='1', y='A', z='?';`	
7	`bool m=0;`	
8	`if (b>m)`	
9	`m=b;`	
10	`else`	
11	`m=d;`	
12		
13	`if (b>e)`	
14	`e=e+2;`	
15	`else`	
16	`a=b;`	
17	`q = static_cast<float>(e/5) * d;`	
18	`p = static_cast <float>(b*d--);`	
19	`a = ++a / 2 + e;`	
20		
21	`if (x==1)`	
22	`m=1;`	
23	`else`	
24	`y='D';`	
26	`cout << a << endl;`	0 ! X
27	`cout << b << endl;`	2 ✓
28	`cout << p << endl;`	2.0 ✓
29	`cout << q << endl;`	0.4 / 0 X
30	`cout << y << endl;`	D ✓
31	`return 0;`	3+1
32	`}`	

Figure B3: C++ program code for Question 1(b)

(c) Identify the output for the program segment shown in **Table B2**. Fill in the **Output** column of the **Table B2** with your answers. **[5 marks]**

Table B2: Program segment and output for Question 1(c)

Line	Code	Output
1	`int x = 10, y = -3;`	
2	`bool k = true;`	
3		
4	`cout << ( (x == 10) || (x < y) ) << endl;`	1
5	`cout << ( (x = y) && (k = 0) ) << endl;`	0
6	`cout << ( (y == -3) && (x == 10) ) << endl;`	0
7	`cout << ( (y != x) || (k != true) ) << endl;`	1
8	`cout << ( (k == true) && (x >= 10) ) << endl;`	0

QUESTION 2 **[15 MARKS]**

Figure B4 below shows the complete C++ code.

```
1  #include <iostream>
2  using namespace std;
3
4  int main()
5  {
6     float choice;
7     int counter;
8     bool flag = 0;
9
10    cout << "\tEnter choice   :  ";
11    cin >> choice;
12    cout << "\tEnter counter  :  ";
13    cin >> counter;
14
15    while (!flag && (counter % 2)==0;)
16    {
17       if ((choice != 'a') && (choice != 'b') &&
18       (choice != 'c'))
19       {  counter += 3;
20          flag = 0;
21       else
22          flag = 1;
23          counter *= 3;}
24    }
```

```
25
26    for (int i = 0; i < counter;)
27    {
28       switch ("choice")
29       {
30          case 'a' : ++i; cout << "one\n";
31                     break;
32          case 'b' : i+=2; cout << "two\n";
33                     break;
34          case 'c' : i+=3; cout << "three\n";
35          default  : i+=4; cout << "four\n";
36                     break;
37       }
38    }
39    return 0;
40 }
```

Figure B4: C++ program code for Question 2

(a) From the **Figure B4**, there are 5 identified syntax errors in the code in the usage of the control structure codes (repetition and selection). Find the line of the code and write the correct code. Write your answer in **Table B3**. [5 marks]

Table B3: Answer for Question 2(a)

Line No.	Correction
15	while(!flag && (counter%2==0))
21 ~~26~~	else { ~~for (int i=0;i<counter)~~
~~35~~ ~~6~~	~~break;~~ ~~char choice;~~
28	switch (choice)
~~34~~ 20	~~flag=0;~~ } ~~case 'c' : i+=3; cout<<"three\n"; break;~~

(b) Assuming that you have identified and found all the errors in Question 2(a), trace the program by filling in the values of the variables in the **Table B4** when the initial value is as shown below. [10 marks]

Table B4: Answer for Question 2(b)

flag	choice	counter
0	c	4
1		12

i	On display
0	
3	three
7	four
10	three
14	four

flag	choice	counter
0	d	12
0		15

i	On display
0	
4	four
8	four
12	four
16	four

(4)

QUESTION 3 **[15 MARKS]**

(a) **Figure B5** below shows the incomplete C++ code for calculating area for a house, complete the C++ code for the program and write your answer in **Table B5**. [5 marks]

```
#include <iostream>
using namespace std;

int main() {
    double length, width;

    //declares a character array named typeOfHouse capable of
    holding 50 characters.
    _____(i);

    int numOfTimes,
    count = 0;

    cout << "Enter the type of house: ";
    _____(ii)>> typeOfHouse;

    cout<<"How many times do you want to calculate the area? ";
    cin >> numOfTimes;

    while(_____(iii))
    {
        cout << "Enter length and width of the rectangle: ";
        cin >> length >> width;
```

dto

```
        double area = length * width;

        cout << "Area of the rectangle (" << length << " x "
        << width << ") for house type '" << typeOfHouse << "'
        is: ";

        //convert data type for the area to int
        cout << _____(iv) << endl;

        //Updating of counter value (increase by 1) during each
        iteration
        _____(v);
    }

    return 0;
}
```

Figure B5: C++ program code for Question 3(a)

Table B5: Answer for Question 3(a)

Question	Answer
(i)	char typeOfHouse[51];
(ii)	cin
(iii)	count < numOfTimes
(iv)	static_cast<int>(area);
(v)	counter = counter + 1

(b) **Figure B6** show a C++ program code that prompts the user to input two numbers that are **`multiplicationNum`** for the multiplication table and **`divisionNum`** for the division table. Additionally, the user should input a range limit (**`limit`**). The program displays the output of the multiplication table for **`multiplicationNum`** and the division table for **`divisionNum`** from 1 up to the specified **`limit`**. **Figure B7** shows an example of the expected output for the specified value of variables below. [10 marks]

From **Figure B6** and **B7**, answer the following questions:

(i). Write code segment for multiplication table. (5 marks)

(ii). Write code segment for division table. Use **static cast** to convert the output to **double** number. (5 marks)

```
#include <iostream>
using namespace std;

int main() {

    int multiplicationNum, divisionNum, limit;

    cout << "Enter a number for multiplication table: ";
    cin >> multiplicationNum;

    cout << "Enter a number for division table: ";
    cin >> divisionNum;

    cout << "Enter the limit: ";
    cin >> limit;

    cout << "Multiplication table for " << multiplicationNum <<
    " up to " << limit << ":" << endl;

    // (i) Write code segment for multiplication table.


    cout << "Division table for " << divisionNum << " up to "
    << limit << ":" << endl;

    // (ii) Write code segment for division table.

    return 0;
}
```

Figure B6: C++ program code for Question 3(b)

```
Enter a number for multiplication table: 10 [Enter]
Enter a number for division table: 12 [Enter]
Enter the limit: 5 [Enter]

Multiplication table for 10 up to 5:
10 x 1 = 10
10 x 2 = 20
10 x 3 = 30
10 x 4 = 40
10 x 5 = 50
```

```
Division table for 12 up to 5:
12 / 1 = 12
12 / 2 = 6
12 / 3 = 4
12 / 4 = 3
12 / 5 = 2.4
```

Figure B7: Example of the C++ program expected output for Question 3(b)

Answer space for Question 3(b)(i) and 3(b)(ii)

3bi.
```
for (int i=1; i<=limit; i++){
    cout<< multiplicationNum<<" x "<<i<<" = "<<(multiplicationNum*i)<<endl;
}
```

3bii.
```
for (int f=1; f<=limit; i++){
    cout<<divisionNum<<" / "<<f<<" = "<<(divisionNum/f)<<endl;
}
```

static_cast<double>

10

QUESTION 4 **[15 MARKS]**

(a) From the C++ program code in **Figure B8**, trace the output and write your answer in the answer column. [5 marks]

Line	Code	Answer
1	`#include <iostream>`	
2	`using namespace std;`	
3		
4	`int main() {`	
5	`int a = 0, b = 0, c = 0, d = 0;`	
6		
7	`cout << "\t\t" << "a" << "\t" << "b" << "\t" << "c" << "\t" << "d\n";`	
8		
9	`cout << "initialize" << "\t";`	
10		
11	`cout << a << "\t" << b << "\t" << c << "\t" << d << "\n";`	
12	`a=0+2*-1 = -2`	a=-2 1 ✗
13	`(a+=2)*(--a);`	b=0 ✓
14	`(--((++b)%=3));` b=1%3=1=0	c=1 0.2 ✗
15	`((++c)/5.0);` (1/5.0)	d=3 ✓
16	`++(d+=2);` ++(d=2)=3	
17		
18	`cout << "update" << "\t\t";`	
19		
20	`cout << a << "\t" << b << "\t" << c << "\t" << d << "\n";`	~~-2~~ 1 0 1 3
21		
22	`return 0;`	2×√
23	`}`	

Figure B8: C++ program code for Question 4(a)

(b) From the C++ program code in **Figure B9**, answer the question (i), (ii) and (iii) by writing the code segments for each task to produce the output in **Figure B10**. [10 marks]

(i). Write the code segment to print even numbers from 1 to 10 (3 marks)

(ii). Write the code segment to print odd numbers from 1 to 10 (3 marks)

(iii). Write the code segment to print prime numbers from 1 to 10 (4 marks)

Note: You are compulsory to apply a **LOOP** using **for/while/do...while AND** apply a **SELECTION** using **if/if...else/switch...case.**

```
#include <iostream>
using namespace std;
int main(){
    cout << "List numbers from 1 to 10\n";

    // Print numbers from 1 to 10
    for (int i = 1; i <= 10; ++i) {

        cout << i << " "; }

        cout << "\n\nEven numbers from 1 to 10\n";
        // (i) Write the code segment to print even numbers
        from 1 to 10

        cout << "\n\nOdd numbers from 1 to 10\n";
        // (ii) Write the code segment to print odd numbers
        from 1 to 10

        cout << "\n\nPrime numbers from 1 to 10\n";
        // (iii) Write the code segment to print prime numbers
        from 1 to 10
    }
    return 0;
}
```

Figure B9: C++ program code for Question 4(b)

```
List numbers from 1 to 10
1 2 3 4 5 6 7 8 9 10

Even numbers from 1 to 10
2 4 6 8 10

Odd numbers from 1 to 10
1 3 5 7 9

Prime numbers from 1 to 10
2 3 5 7
```

Figure B10: C++ program output for Question 4(b)

Answer space for Question 4(b)(i), 4(b) (ii) and 4(b)(ii)

4bi.
```
for(int a=1; a<=10; a++){
    if(a%2==0)
        cout<<a<<" ";
    else
        continue;
}
```
3

4bii.
```
for(int b=1; b<=10; b++){
    if(b%2==1)
        cout<<b<<" ";
    else
        continue;
}
```
3

4biii.
```
for(int d=1; d<=10; d++){
    if((d==2)||(d==3)||(d==5)||(d==7))
        cout<<d<<" ";
    else
        continue;
}
```
4