The State of Israel
Ministry of Education
Exam Type:
א. *Bagrut* for high schools
ב. *Bagrut* for external examinees
Exam Date: Summer 2013
Exam Number: 899222, 602
English Translation (3)

מדינת ישראל
משרד החינוך
סוג הבחינה:
א. בגרות לבתי ספר על־יסודיים
ב. בגרות לנבחנים חיצוניים
מועד הבחינה: קיץ תשע"ג, 2013
מספר השאלון: 899222, 602
תרגום לאנגלית (3)

Computer Science

2 points

Instructions for examinees

א. Duration of the exam: Three hours

ב. Exam structure and breakdown of points:
This exam has three parts.
Part 1 — Answer all five questions 1-5.
Each question — 10 points
(5 × 10) — 50 points
Part 2 — Answer two of the questions 6-8.
Each question — 15 points
(2 × 15) — 30 points
Part 3 — Answer one of the questions 9-10.
One question — 20 points
(1 × 20) — 20 points
Total — 100 points

ג. Material that may be used during the exam:
All material, except a programmable computer.

ד. Special instructions:
(1) Write all of the programs you are asked to write in one programming language only.
(2) **On the outside cover** of the answer booklet, write which programming language you are using — Java or C#.

Note: In the programs you write, you will not lose points for writing a capital letter instead of a lower-case letter or vice versa.

מדעי המחשב

2 יחידות לימוד

הוראות לנבחן

א. משך הבחינה: שלוש שעות.

ב. מבנה השאלון ומפתח ההערכה:
בשאלון זה שלושה פרקים.
פרק ראשון — יש לענות על חמש השאלות 1-5.
לכל שאלה — 10 נקודות
(5×10) — 50 נקודות
פרק שני — יש לענות על שתיים מהשאלות 6-8.
לכל שאלה — 15 נקודות
(2×15) — 30 נקודות
פרק שלישי — יש לענות על אחת מהשאלות 9-10.
לשאלה — 20 נקודות
(1×20) — 20 נקודות
סה"כ — 100 נקודות

ג. חומר עזר מותר בשימוש:
כל חומר עזר, חוץ ממחשב הניתן לתכנות.

ד. הוראות מיוחדות:
(1) כתוב בשפה אחת בלבד את כל התוכניות שאתה נדרש לכתוב.
(2) **רשום על הכריכה החיצונית** של המחברת את שפת המחשב שבה אתה כותב — Java או C#.

הערה: בתכניות שאתה כותב לא יורדו לך נקודות, אם תכתוב אות גדולה במקום אות קטנה או להפך.

רשום "טיוטה" בראש כל עמוד טיוטה. רישום טיוטות כלשהן על דפים מחוץ למחברת הבחינה עלול לגרום לפסילת הבחינה!
כתוב במחברת הבחינה בלבד, בעמודים נפרדים, כל מה שברצונך לכתוב כטיוטה (ראשי פרקים, חישובים וכדומה).

Write "טיוטה" at the top of each draft page. Writing drafts on pages outside the answer booklet may lead to the disqualification of the exam! Write only in the answer booklet. Use separate pages for everything you want to use as draft material (outlines, calculations, etc.).

Good Luck!

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בהצלחה !

/המשך מעבר לדף/

Questions

Note: Use only one programming language for all of the programs you are asked to write.
On the outside cover of the answer booklet, write which programming language you are using – Java or C#.

Part One (50 points)

Answer all five questions 1-5 (each question – 10 points).

1. An algorithm is shown below:

(1) c ← 0
(2) f ← 4
(3) **for** i from 1 to f (inclusive) **do**
  (3.1) input a number for the variable d
  (3.2) **if** d is equal to i **or** d is less than 3 **then**
    (3.2.1) c ← c + d
  (3.3) **otherwise**
    (3.3.1) display the message "no" as output
(4) display the value of c as output

Using a trace table, follow the execution of the algorithm for the input:
2 , 5 , 7 , 4 , and write the output that is obtained.
The trace table should include:
a column for each of the variables in the algorithm,
a column that indicates whether the condition in line (3.2) occurs or does not occur,
and a column for the output.

2. Write a method in Java or C# that will receive two integers and a character.
The character can be either '+' or '*' .
The method will return the sum of the two numbers, if the character is '+' .
The method will return the product of the two numbers, if the character is '*' .

3. Given: an array arr which contains integers.
Write a program segment in Java or C# that will count and present as output the number of elements in the array in which a two-digit number is stored.

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4. Below is the heading of a method written in Java and C#.
Heading of the method in Java: public static int big3 (int a , int b , int c)
Heading of the method in C# : public static int Big3 (int a , int b , int c)
The method receives three different integers and returns the greatest number of the three.

A program segment written in Java and C# is presented below.
The program segment uses the method whose heading is given above.

Java

```
int n1 = 8; int n2 = 5; int n3 = 3; int n4 = 1; int n5 = 7;
int m1 = big3 (n1 , n2 , n3);
int m2 = big3 (n2 , n3 , n4);
int m3 = big3 (n3 , n4 , n5);
int last = big3 (m1 , m2 , m3);
if (last == 8)
      System.out.println ("***");
else
      System.out.println ("---");
```

C#

```
int n1 = 8; int n2 = 5; int n3 = 3; int n4 = 1; int n5 = 7;
int m1 = Big3 (n1 , n2 , n3);
int m2 = Big3 (n2 , n3 , n4);
int m3 = Big3 (n3 , n4 , n5);
int last = Big3 (m1 , m2 , m3);
if (last == 8)
      Console.WriteLine ("***");
else
      Console.WriteLine ("---");
```

Using a trace table, follow the execution of the program segment and write the output that is obtained.

The trace table should include:
a column for each of the variables in the program segment,
a column that indicates whether the condition occurs or does not occur,
and a column for the output.

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5. The class Numbers is given. The following program segment, written in Java and C#, is in this class.

For those using Java: Assume that the following instruction exists in the program:

```
Scanner input = new Scanner(System.in);
```

Java

```
int num1 = 30;
int num2 = 10;
for (int i = 0 ; i < 5 ; i++)
{
      int number = input.nextInt();
      if ((number < num1) && (number > num2))
            System.out.print("*");
      else
            System.out.print("$");
}
```

C#

```
int num1 = 30;
int num2 = 10;
for (int i = 0 ; i < 5 ; i++)
{
      int number = int.Parse (Console.ReadLine());
      if ((number < num1) && (number > num2))
            Console.Write("*");
      else
            Console.Write("$");
  }
```

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א. Using a trace table, follow the execution of the program segment for the input: 9 , 40 , 25 , 12 , 0 , and write the output that is obtained.
The trace table should include:
a column for each of the variables in the program segment,
a column that indicates whether the condition in the if statement does or does not occur,
and a column for the output.

ב. Provide a representative example of the input for which the output will be:
$$$$$

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Part Two (30 points)

Answer two of the questions 6-8 (each question – 15 points).

6. A high school is preparing for a national computer science competition.
Students were given three qualifying tests to determine who could participate in the competition.

A student who earns a score higher than 90 on each of the three tests can participate in the competition.

א. Write a method in Java or C# that receives 3 whole numbers between 0 and 100 (inclusive) that represent a student's scores.
The method will return the number of scores that are greater than 90.

ב. Write a program segment in Java or C# that accepts as input the number of students who took the qualifying tests for the competition.
For each one of these students, the program segment will receive as input the student's name and his/her scores on the three tests.
The program segment will print the names of the students who may participate in the national competition.
The program segment will also count the number of students who may participate in the national competition and print that number.
You must use the method you wrote in Item א.
Note: There is no need to check the validity of the input.

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7. Two arrays containing integers [מטיפוס שלם] are given:
a of size 9 and b of size 8.
Array a contains numbers greater than 0 and array b contains only zeros.

	0	1	2	3	4	5	6	7	8
a	2	8	8	8	12	24	7	7	6

	0	1	2	3	4	5	6	7
b	0	0	0	0	0	0	0	0

The class Stam is given. This class includes the program segment written in Java and C# below.

Java

```
int count = 0;
for (int i = 0; i < (a.length()−1); i++)
{
    if (a[i] == a[i+1])
    {
        b[count] = a[i];
        count ++;
    }
}
```

C#

```
int count = 0;
for (int i = 0; i < (a.Length−1); i++)
{
    if (a[i] == a[i+1])
    {
        b[count] = a[i];
        count ++;
    }
}
```

א. Using a trace table, follow the execution of the program segment for the given arrays, a and b, and write out array b after the execution of the program segment.
The trace table should include:
a column for each of the variables: i, a[i], a[i+1], count and b[count], and a column that indicates whether the condition in the if statement does or does not occur.

ב. Provide a representative example for array a of size 9, which contains numbers greater than 0, for which array b will contain only zeros after the execution of the program segment.

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8. A travel agency is organizing a trip for families.

The price per participant is 100 shekels. The number of spots is limited.

Write a program in Java or C# that will accept as input the number of spots for participants on the trip.

For each family that signs up, the program will also receive as input their last name and the number of family members registered for the trip.

A family will not be able to participate if the number of family members wishing to sign up is greater than the number of available spots.

For each family that will not be able to go on the trip, the program will print that family's name and the message "no".

For each family that will go on the trip, the program will print that family's name and calculate and print the total sum that family must pay for the trip.

The input will end when there are no more available spots on the trip.

Note: There is no need to verify the validity of the input.

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Part Three (20 points)

Answer one of the questions 9-10.

9. Given: A two-dimensional array containing whole numbers.
A row in the array will be called a **positive row** if all of the elements in that row are greater than 0. A column will be called a **positive column** if all of the elements in that column are greater than 0.
Example : In the array of size 3 × 5 below,
Row 1 is a **positive row** and Column 3 is a **positive column**.

	0	1	2	3	4
0	1	−2	15	4	0
1	12	3	28	6	7
2	0	5	−57	12	−3

א. Write a method in Java or C# that receives:
— a two-dimensional array containing integers.
— an integer k that represents a row in the array.
The method will check whether k is a **positive row**.
If it is, the method will return 1; otherwise, the method will return 0.

ב. Write a method in Java or C# that receives:
— a two-dimensional array containing integers.
— an integer j that represents a column in the array.
The method will check whether j is a **positive column**.
If it is, the method will return 1; otherwise, the method will return 0.

ג. A two-dimensional array will be called a **positive row array** if the number of **positive rows** it contains is greater than the number of **positive columns**.
Given: A two-dimentional array arr of size 45 × 42 containing integers.
Write a program in Java or C# to check whether array arr is a **positive row array**.
If it is, the message "yes" will be printed; otherwise, the program will print the message "no".
You must use the methods you wrote for Items א and ב.
Note: There is no need to input the array.
There is no need to verify the validity of the array.

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10. A book store had a sale. The sale is for customers who purchase 2 or 3 books that have different prices.

A customer who buys 2 books will pay half price for the cheaper of the two.

A customer who buys 3 books will receive the cheapest one for free.

Given: A method that receives three different real numbers greater than 0 that represent prices of books, and returns the sum of the two higher numbers from among the three.

The method headings are shown below in Java and C# :

Method heading in Java:

public static double sum2max (double price1, double price2, double price3)

Method heading in C#:

public static double Sum2max (double price1, double price2, double price3)

א. Write a method in Java or C# that will receive two different real numbers that are each greater than 0, which each represent the price of a book. The method will return the sum that a customer will pay for those two books that he purchased on sale.

ב. Write a method in Java or C# that will receive the number of books that a certain customer bought on sale. This number can be 2 or 3. The method inputs the prices of the books that were purchased and returns the sum that the customer must pay according to the terms of the sale.
You must use the given method and the method you wrote for Item א.

ג. On a certain day, 142 customers took advantage of the sale. Write a program in Java or C# that will receive as input, for each customer who received a discount, the number of books purchased by that customer. The program will calculate the total price that the customer must pay for the books that he bought and will print that number.
You must use the method you wrote for Item ב.

Note: There is no need to verify the validity of the input.

Good Luck!

בהצלחה!