

La comprensione del codice nella didattica della programmazione

Le tre dimensioni: codice del programma, programma in esecuzione, scopo del programma

Attività da svolgere in gruppo

Il seguente frammento di programma stampa la frequenza della temperatura più alta in un array di interi:

```
1  int [] l = {20 ,24 ,23 ,35 ,30 ,35};
2  int a=1;
3  int b=l[0];
4  for( int i=1; i<l.length; i++ ){
5      |   if( l[i]>b ){
6          |       b=l[i];
7          |       a=1;
8          |   } else {
9          |       if( l[i]==b ){
10         |           a++;
11         |       }
12     }
13 }
14 System.out.println(a);
```

Qui sotto sono riportate 12 domande di comprensione del codice (con relativa risposta, in corsivo), tratte dal Report ITiCSE-WGR '19¹.

Individuate quattro domande (distinte) per ciascuna delle tre dimensioni statica (T-testo del codice sorgente), dinamica (P - il programma in esecuzione), scopo/funzione (F- il problema risolto). Poi classificatele tutte anche secondo la dimensione Atom, Bock, Relation, Macro. Le 12 domande coprono tutte e 12 le possibili classificazioni, quindi ne dovrete trovare una per ciascun tipo.

¹ Izu, C., Schulte, C., Aggarwal, A., Cutts, Q., Duran, R., Gutica, M., Heinemann, B., Kraemer, E., Lonati, V., Mirolo, C., et al. (2019). Fostering Program Comprehension in Novice Programmers - Learning Activities and Learning Trajectories. In: *Proc. of the Working Group Reports on Innovation and Technology in Computer Science Education*. ITiCSE-WGR '19. ACM, New York, NY, USA, pp. 27–52. 9781450368957. <https://doi.org/10.1145/3344429.3372501>.

a)

Determine the value of a after execution.

A : a has the value 2.

b)

Identify and check all potential execution flows. Does each statement get executed at least once?

A: The code block below will not be executed if all elements in the array have the same value or if they are all smaller than the first element.

```
b=l[i];  
a=1;
```

c)

Given that array l represents daily temperature measurements and b is the maximum temperature measured before day i , what is the purpose of test $l[i] > b$ in terms of the problem?

A: Tests if the temperature on day i is higher than b , hence hotter than any previous day.

d)

Describe the purpose of this block of code.

```
int[] l = {20,24,23,35,30,35};  
int b=l[0];  
for(int i=0; i< l.length; i++){  
    if(l[i]>b){  
        b=l[i];  
    }  
}  
System.out.println(b);
```

A: The block determines, stores in variable b , and prints the maximum temperature in a given array.

e)

Draw a box around the code that belongs to the else statement.

```
int[] l = {20,24,23,35,30,35};
int a=1;
int b=l[0];
for( int i=1; i<l.length; i++ ){
    if( l[i]>b ){
        b=l[i];
        a=1;
    } else {
        if( l[i]==b ){
            a++;
        }
    }
}
System.out.println(a);
```

f)

Identify the scope of variable b.

```
int[] l = {20,24,23,35,30,35};
int a=1;
int b=l[0];
for( int i=1; i<l.length; i++ ){
    if( l[i]>b ){
        b=l[i];
        a=1;
    } else {
        if( l[i]==b ){
            a++;
        }
    }
}
System.out.println(a);
```

g)

Draw a box around each assignment statement.

```
int[] l = {20,24,23,35,30,35};
int a=1;
int b=l[0];
for( int i=1; i<l.length; i++){
    if( l[i]>b ){
        b=l[i];
        a=1;
    } else {
        if( l[i]==b ){
            a++;
        }
    }
}
System.out.println(a);
```

h)

Draw nested boxes to indicate the overall program block structure.

```
int[] l = {20,24,23,35,30,35};
int a=1;
int b=l[0];
for( int i=1; i<l.length; i++){
    if( l[i]>b ){
        b=l[i];
        a=1;
    } else {
        if( l[i]==b ){
            a++;
        }
    }
}
System.out.println(a);
```

i)

The following program segment should print the highest value in the array. Rearrange the blocks into the `for` loop in the correct order to complete the program.

Drag from here	Drop blocks here
4 <code>int b=l[0];</code>	6 <code>int[] l = {20,24,23,35,30,35};</code>
1 <code>}</code>	2 <code>b=l[i];</code>
5 <code>if(l[i] > b){</code>	7 <code>for(int i=0;i < l.length;i++){</code>
	8 <code>}</code>
	3 <code>System.out.println(b);</code>

l)

For the code below, propose a more appropriate initialization than `int b = 0`.

```
int[] l = {20,24,23,35,30,35};
int a=1;
int b=0;
for( int i=0; i<l.length; i++ ){
    if( l[i]>b ){
        b=l[i];
        a=1;
    } else {
        if( l[i]==b ){
            a++;
        }
    }
}
System.out.println(a);
```

A: b, which is the maximum value in the temperature array could be negative.

A better alternative could be `int b = l[0]`

m)

The code and diagram below represent the same program. Complete both so they have a correct behavior.

```
int[] l = {20,24,23,35,30,35};
int a=1;
??
for( ?? ){
    if( l[i]>b ){
        ??
        a++;
    } else {
        if( l[i]==b ){
            ??
        }
    }
}
System.out.println(a);
```



n)

Summarize the goal of the program using a short sentence.

A: Prints the frequency of the highest temperature in the array.