## Sample exam 1

The INFDEV team

## 1 Question 1

Given the following block of code, fill in the stack, heap, and PC with all steps taken by the program at runtime.

- Points: 4 (50% of total).
- Grading: one point per correctly filled-in execution step.
- Associated learning objective: abstraction.

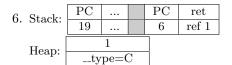
```
interface A {
        int M(int x);
   2
   3
      class C : A {
   5
       public C() {
   6
       public int M(int x) {
   8
          return (x + 2);
   9
       }
  10
  11
      class D : A {
       public D() {
  12
  13
  14
       public int M(int x) {
          return (x + 2);
  15
\sim 16
       }
  17
  18
     A myA = new C();
     Console.WriteLine(myA.M(5));
```



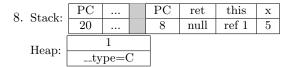
- 2. Stack: PC 18
- 3. Stack: PC 19
- 4. Stack: PC 19

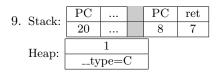
  Heap: 1

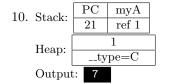
  \_\_type=C











## 2 Question 2

Given the following block of code, fill in the declarations, class definitions, and PC with all steps taken by the compiler while type checking.

- Points: 4 (50% of total).
- $\bullet$  Grading: one point per correctly filled-in type checking step.
- Associated learning objective: type checking.

```
interface A {
   int M(int x);
}

class C : A {
   public C() {
   public int M(int x) {
      return (x + 2);
   }
}
```

```
class D : A {
     public D() {
12
13
     public int M(int x) {
14
       return (x + 2);
15
16
     }
17
   }
18
   A myA = new C();
19
   Console.WriteLine(myA.M(5));
```

- 1. Declarations:  $\begin{array}{|c|c|c|c|}\hline PC \\ \hline 1 \\ \hline \end{array}$

7. Declarations:		myA		PC	ret	$arg_1$	this		
i. Deciaran	ons.	A		20	null	int	A		
		A				(	C		D
Classes:		$M=(A\times int) \to int$				C=C			$D=D \rightarrow D$
	1V1	—(A×III	$M=(C\times int) \to int$ $M=(C\times int) \to i$		int	$M=(D\times int) \to int$			

8. De

eclarations:		myA		PC	ret	$arg_1$	this
		A		20	int	$_{ m int}$	A
		Δ					C

Classes:

Classes:

A	C	D
$M=(A\times int) \rightarrow int$	$C=C \rightarrow C$	$D=D \rightarrow D$
$M = (A \times IIIt) \rightarrow IIIt$	$M=(C\times int) \to int$	$M=(D\times int) \to int$

PC myA 21 A 9. Declarations:

A	C	D
$M = (A \times int)$ int	$C=C \rightarrow C$	$D=D \rightarrow D$
$M=(A\times int) \to int$	$M=(C\times int) \rightarrow int$	$M=(D\times int) \rightarrow int$