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.*

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

1. Stack:

PC
1

2. Stack:

PC
18

3. Stack:

PC
19

4. Stack:

PC
19

   Heap:

1

5. Stack:

PC	...		PC	ret	this
19	...		6	null	ref 1

   Heap:

1

6. Stack:

PC	...		PC	ret
19	...		6	ref 1

Heap:

1

7. Stack:

PC	myA
20	ref 1

Heap:

1

8. Stack:

PC	...		PC	ret	this	x
20	...		8	null	ref 1	5

Heap:

1

9. Stack:

PC	...		PC	ret
20	...		8	7

Heap:

1

10. Stack:

PC	myA
21	ref 1

Heap:

1

Output: 7

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).*
- Grading: one point per correctly filled-in type checking step.
- Associated learning objective: *type checking.*

```
1  interface A {
2    int M(int x);
3  }
4  class C : A {
5    public C() {
6    }
7    public int M(int x) {
8      return (x + 2);
9    }
10 }
```

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

1. Declarations:

PC
1

2. Declarations:

PC
4

Classes:

A
M=(M×int) → int

3. Declarations:

PC
10

Classes:

A	C
M=(M×int) → int	C=C → C M=(C×int) → int

4. Declarations:

PC
18

Classes:

A	C	D
M=(M×int) → int	C=C → C M=(C×int) → int	D=D → D M=(D×int) → int

5. Declarations:

PC
19

Classes:

A	C	D
M=(M×int) → int	C=C → C M=(C×int) → int	D=D → D M=(D×int) → int

6. Declarations:

PC	myA
20	A

Classes:

A	C	D
M=(M×int) → int	C=C → C M=(C×int) → int	D=D → D M=(D×int) → int

7. Declarations:

myA		PC	ret	arg_1	this
A		20	null	int	A

Classes:

A	C	D
M=(M×int) → int	C=C → C M=(C×int) → int	D=D → D M=(D×int) → int

8. Declarations:

myA		PC	ret	arg_1	this
A		20	int	int	A

Classes:

A	C	D
M=(M×int) → int	C=C → C M=(C×int) → int	D=D → D M=(D×int) → int

9. Declarations:

PC	myA
21	A

Classes:

A	C	D
M=(M×int) → int	C=C → C M=(C×int) → int	D=D → D M=(D×int) → int