

CAML
MCQ #6
Friday, September the 15th 2023

1. Among the following phrases, which are improper?

- X (a) `3 * 1.5 ;;`
- (b) `let a = 1. and b = 3. in (a +. 2.) <= (4. -. b) ;;`
- X (c) `let a = 1. and b = 3 in (a +. 2.) <= (4 - b) ;;`
- (d) `(4 < 8) || ("a" = "b") ;;`
- (e) None of the above.

2. Let `f`, `g`, `x` and `y`, all be defined in the current environment. Among the following expressions, which are equivalent to `(f x) + g y`?

- X (a) `f(x) + g(y)`
- X (b) `fx + gy`
- (c) `f(x + g) y`
- (d) `((f x + g) y)`
- X (e) `(f x + (g y))`

3. What should be the types of functions `f` and `g` so that the following expression is correct?
`f ((g (3*2) 4)+1) (5 - f 1 2) ;;`

- (a) `f : int -> int` and `g : int -> int`
- (b) `f : int -> int` and `g : int -> int -> int`
- (c) `f : int -> int -> int` and `g : int -> int`
- X (d) `f : int -> int -> int` and `g : int -> int -> int`
- (e) None of the above.

4. What is the evaluation result of the following definition?

```
let f x y =  
  let f2 x y z = z = (x + y)/2 in  
  let f3 = f2 x y 10 > f2 x y 8 in  
  f3 < true ;;
```

- (a) `val f : int -> bool -> bool = <fun>`
- X (b) `val f : int -> int -> bool = <fun>`
- (c) `val f : int -> int -> int -> bool = <fun>`
- (d) `val f : int -> int -> bool -> bool = <fun>`
- (e) An error.

5. What does the evaluation result of the following phrase contain?

```
let square x = match x with  
  x when x > 0 -> x * x  
  | y -> invalid_arg "x has to be positive" ;;
```

- (a) `val square : int -> string = <fun>`
- X (b) `val square : int -> int = <fun>`
- (c) ... Warning ...: this pattern-matching is not exhaustive...
- (d) ... Warning ...: this match case is unused.
- (e) Another "Warning".

6. Let the function `g`, be defined as follows. Which statements are true?

```
let g x y = match x with
  | 0 -> 0
  | x -> 1
  | y -> -1 ;;
```

- (a) The two parameters (`x` and `y`) have to be of the same type.
- X (b) `y` can be of any type.
- (c) `x` can be of any type.
- X (d) The function never returns `-1`.
- (e) If `x ≠ 0` and `x ≠ y`, the function returns `-1`.

7. What will be the last result after successive evaluations of the following phrases?

```
let a = 2 ;;
let f x = a*x ;;
f 2 * (function x -> x+1) (2*5) ;;
```

- (a) `val f : int -> int = <fun>`
- (b) `- : int = 22`
- X (c) `- : int = 44`
- (d) `- : int = <fun>`
- (e) An error.

8. What is the type of the function `f` defined below?

```
let f = function
  | (_,0) -> 0
  | (x,y) when x=y -> 1
  | - -> -1 ;;
```

- (a) `int -> int -> int`
- X (b) `int * int -> int`
- (c) `'a * 'b -> int`
- (d) `'a -> 'a -> int`
- (e) The function is incorrect.

9. What is the type of the function `f` defined below?

```
let rec f =
  let g = function x -> x=0 in
  function
    | (x,y) when g y -> x
    | (x,y) -> f (x,y-1) ;;
```

- (a) `int -> int -> int`
- (b) `int * int -> int`
- X (c) `'a * int -> 'a`
- (d) The function is incorrect.

10. For which values of x the following function does not stop for sure in theory?

```
let rec f = function
  0 | 1          -> 1
  | x when x < 0 -> f(3*x)
  | x when x mod 2 < 0 -> f(x-2)+1
  | x           -> f x ;;
```

- * (a) $x < 0$.
 - * (b) $x > 0$ and even.
 - (c) x odd.
 - (d) It stops for any value of x .
 - (e) It never stops.
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Question 11

Let x be a real number. Select the correct answer(s)

- a. $x > 1 \implies x \geq 1$
- b. $x \geq 1 \implies x > 1$
- c. $e^x = 2 \implies x = \ln(2)$
- d. $x = \ln(2) \implies e^x = 2$
- e. None of the others

Question 12

The negation of "All the tulips are red" is:

- a. "No tulip is red"
- b. "Some tulips are not red"
- c. "There exist blue tulips"
- d. None of the others

Question 13

Let f be a function defined on \mathbb{R} . The negation of: " $\forall x \in \mathbb{R}, \exists y \in \mathbb{R}, x = f(y)$ " is:

- a. $\forall x \in \mathbb{R}, \exists y \in \mathbb{R}, x \neq f(y)$
- b. $\exists x \in \mathbb{R}, \forall y \in \mathbb{R}, x = f(y)$
- c. $\exists x \in \mathbb{R}, \exists y \in \mathbb{R}, x \neq f(y)$
- d. $\exists x \in \mathbb{R}, \forall y \in \mathbb{R}, x \neq f(y)$
- e. None of the others

Question 14

Let $x \in \mathbb{R}$ and consider the property P : " $x > 0 \implies x \geq 0$ ".

- a. The negation of P is: " $x < 0 \implies x \leq 0$ "
- b. The negation of P is: " $x > 0 \wedge x < 0$ "
- c. The contrapositive of P is: " $x < 0 \implies x \leq 0$ "
- d. The contrapositive of P is: " $x > 0 \wedge x < 0$ "
- e. None of the others

Question 15

Consider the set $E = \{0, 1, 2, 3\}$. Select the correct answer(s):

- a. $1 \subset E$
- b. $3 \in E$
- c. $\{0\} \in E$
- d. $\{0, 2\} \subset E$
- e. None of the others

Question 16

Let $E = \{(0, 1), (0, 2), (0, 3), (1, 1), (1, 2), (1, 3)\}$. Then $E = A \times B$ with

- a. $A = B = \{0, 1, 2, 3\}$
- b. $A = \{1, 2, 3\}$ and $B = \{0, 1\}$
- c. $A = \{0, 1\}$ and $B = \{1, 2, 3\}$
- d. We cannot know what A and B are.

Question 17

Let E be F two sets and $f : E \rightarrow F$. The function f is injective if and only if:

- a. $\forall (x, x') \in E^2, x = x' \implies f(x) = f(x')$
- b. $\forall (x, x') \in E^2, x \neq x' \implies f(x) \neq f(x')$
- c. $\forall (x, x') \in E^2, x = x'$ and $f(x) \neq f(x')$
- d. $\forall (x, x') \in E^2, x \neq x'$ and $f(x) = f(x')$
- e. None of the others

Question 18

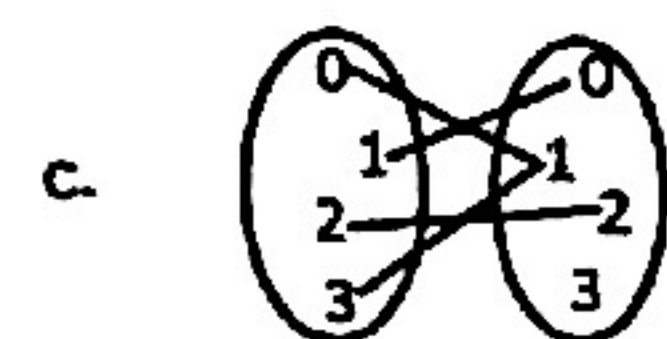
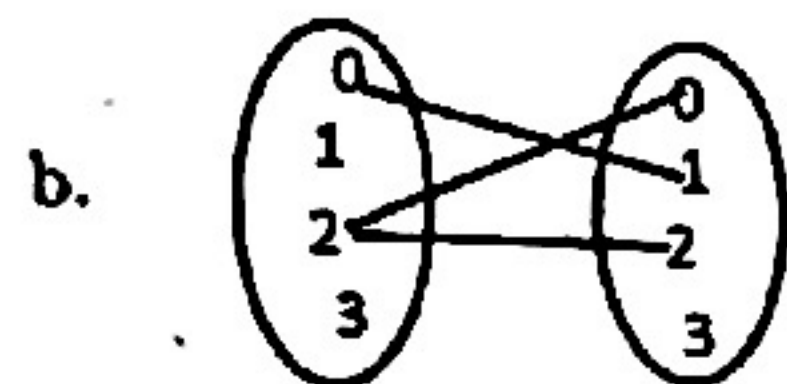
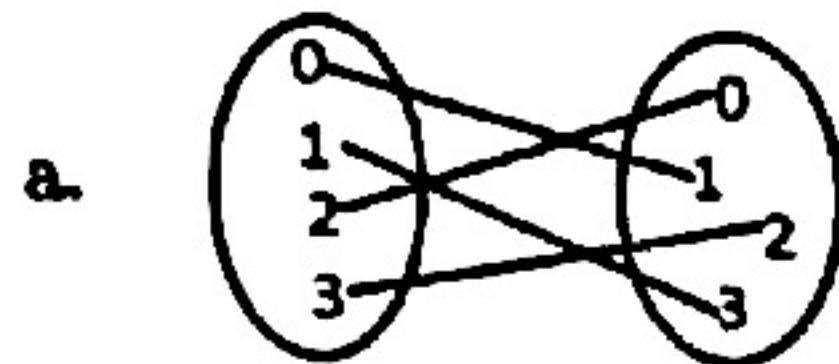
Let I and J be two intervals of \mathbb{R} and $f : \begin{cases} I \rightarrow J \\ x \mapsto |x| \end{cases}$

- a. If $I = J = \mathbb{R}$, then f is bijective.
- b. If $I = [0, +\infty[$ and $J = \mathbb{R}$, then f is bijective.
- c. If $I = \mathbb{R}$ and $J = [0, +\infty[$ then f is bijective.
- d. If $I = J = [0, 5]$ then f is bijective.
- e. None of the others

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Question 19

Which of these figures represent(s) a function $f : \{0, 1, 2, 3\} \rightarrow \{0, 1, 2, 3\}$ such that $f^{-1}(\{0, 2\}) = \{1, 2\}$?



- d. None of these figures

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Question 20

In $E = \mathbb{N}$, consider the relation \mathcal{R} defined by: $\forall (a, b) \in E^2, a \mathcal{R} b \iff \exists n \in \mathbb{N}$ such that $b = a^n$. Then:

- a. $2 \mathcal{R} 8$
- b. $8 \mathcal{R} 2$
- c. \mathcal{R} is reflexive.
- d. \mathcal{R} is symmetric.
- e. None of the others

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