COL 765: Introduction to Logic and Functional Programming
Quiz 3, 12.08.2024
(Programming with User-defined data types)

Name: _____SOLUTION_____ Entry No. __XXXX__

Consider the following data type for a 3-valued logic:

```
type decision = Yes | No | Maybe ;;
```

Q1 [5] Consider a situation where two people are asked if they will volunteer for a task. Each may answer `Yes`, `No`, or `Maybe`. Write a function

```
mostFav: decision -> decision -> decision
```

(a program in OCaml) which will determine the most favourable decision for volunteering for the task amongst two people asked. (`No` worse than `Maybe`. `Maybe` worse than `Yes`).

```
let mostFav d1 d2 = match d1 with
    No -> d2
  | Maybe ->
      (match d2 with
         No -> Maybe
       | Maybe -> Maybe
       | Yes -> Yes)
  | Yes -> Yes
;;
```

Q2 [3+2] Consider now the data type

```
type  certainty = Unsure |  Sure of bool ;;
```

which captures whether an outcome is certain (`Sure`), and if so, whether it is positively so (`true`) or negatively so (`false`), or whether it is not certain (`Unsure`).

(a) Write a program

```
isItCertain : decision -> certainty
```

to express whether a given decision is a certainty or not

```
let isItCertain d = match d with
    No -> Sure false
  | Yes -> Sure true
  | Maybe -> Unsure
;;
```

(b) Now use functions `mostFav` and `isItCertain` to yield a functional program

```
isVolunteerCertain : decision -> decision -> certainty
```

that yields the certainty of whether or not there is a volunteer among the two people asked:

```
let isVolunteerCertain d1 d2 = isItCertain(mostFav d1 d2);;
```

Tests

```
isVolunteerCertain Yes No;;
isVolunteerCertain Maybe No;;
isVolunteerCertain No No;;
isVolunteerCertain No Maybe;;
isVolunteerCertain No Yes;;
isVolunteerCertain Maybe Yes;;
isVolunteerCertain Maybe Maybe;;
isVolunteerCertain Yes Maybe;;
isVolunteerCertain Yes Yes;;
```