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Assignment 1

At first, it seemed like there was a solution, but I forgot that there can not be any negative amount of marbles

```
C:\Users\metal\OneDrive\Desktop\Exam_HandIn>z3 assignment1.smt2
sat
(model
  (define-fun Marbles ((x!0 Int)) Int
    (ite (= x!0 0) 4
    (ite (= x!0 1) (- 1)
    (ite (= x!0 2) (- 2)
    (ite (= x!0 4) 10
      5)))))
)
```

After adding the requirement for there to not be any negative numbers, z3 could not find a solution anymore

```
C:\Users\metal\OneDrive\Desktop\Exam_HandIn>z3 assignment1.smt2
unsat
(error "line 43 column 10: model is not available")
```

My approach was to have a function that takes an Int (a timestamp) and returns another int

This function has to be positive, has an initial and end value and is given an or operator of 3 functions.

Assignment 2

At first this assignment seemed like a lot to write. But I remembered that we did such an exercise before – I reused my solution from week 1 assignment 2 (If I recall correctly) – I only needed to change the statements which needed to be true.

I basically gave them the answer limit – they must be distinct and between 1 and 9, and then proceeded with the statement and that was it.

```
C:\Users\metal\OneDrive\Desktop\Exam_HandIn>z3 assignment2.smt2
sat
(model
  (define-fun I () Int
    6)
  (define-fun H () Int
    2)
  (define-fun G () Int
    3)
  (define-fun F () Int
    1)
  (define-fun E () Int
    4)
  (define-fun D () Int
    5)
  (define-fun C () Int
    8)
  (define-fun B () Int
    9)
  (define-fun A () Int
    7)
)
```

Assignment 3

I decided to express the Items as functions, to which you pass a day (1 to 6) and they return 1 or 0; 1 means they were sold today and 0 means they weren't sold today. I made sure the answer limits were correct and created 6 functions that determine the day on which an item is sold. Then I put the general conditions in and started the questions.

a) Answer i) is correct. Z3 couldn't find a model for ii)

i

```
C:\Users\metal\OneDrive\Desktop\Exam_HandIn>z3 assignment3.smt2
sat
(model
  (define-fun GetDayForSellingVase () Int
    6)
  (define-fun GetDayForSellingTable () Int
    3)
  (define-fun GetDayForSellingSundial () Int
    2)
  (define-fun GetDayForSellingMirror () Int
    4)
  (define-fun GetDayForSellingLamp () Int
    5)
  (define-fun GetDayForSellingHarmonica () Int
    1)
```

ii

```
C:\Users\metal\OneDrive\Desktop\Exam_HandIn>z3 assignment3.smt2
unsat
(error "line 151 column 10: model is not available")
```

b) Answer ii) is correct. Z3 didn't find a model for i)

i

```
C:\Users\metal\OneDrive\Desktop\Exam_HandIn>z3 assignment3.smt2
unsat
(error "line 157 column 10: model is not available")
```

ii – here I also found out I did not implement a limit that makes sure all items get sold – I put it there and retested my previous question, everything still works out

```
sat
(model
  (define-fun GetDayForSellingVase () Int
    3)
  (define-fun GetDayForSellingTable () Int
    4)
  (define-fun GetDayForSellingSundial () Int
    2)
  (define-fun GetDayForSellingMirror () Int
    6)
  (define-fun GetDayForSellingLamp () Int
    1)
  (define-fun GetDayForSellingHarmonica () Int
    5)
```

c) I is correct. Ii is wrong (no model found)

I

```
(model
  (define-fun GetDayForSellingVase () Int
    4)
  (define-fun GetDayForSellingTable () Int
    5)
  (define-fun GetDayForSellingSundial () Int
    2)
  (define-fun GetDayForSellingMirror () Int
    3)
  (define-fun GetDayForSellingLamp () Int
    1)
  (define-fun GetDayForSellingHarmonica () Int
    6)
```

Ii

```
C:\Users\metal\OneDrive\Desktop\Exam_HandIn>z3 assignment3.smt2
unsat
(error "line 180 column 10: model is not available")
```