Homework3

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1 Chapter 12

1.1 Problem 5

```
clear Z
incr X
while X not 0:
    clear temp1
    while Y not 0:
        decr Y
        incr temp1
    while temp1 not 0:
        decr temp1
        incr Y
        decr X
    incr Z
while Z not 0:
    decr Z
    incr X
decr X
```

X represents the final answer.

1.2 Problem 15

Current state	Current cell content	Value to write	Direction to move	New state to enter
START	*	*	Left	PACK
PACK	0	*	Right	MOVE0
PACK	1	*	Right	MOVE1
MOVE0	0	0	Right	MOVE0
MOVE0	1	1	Right	MOVE0
MOVE1	0	0	Right	MOVE1
MOVE1	1	1	Right	MOVE1
MOVE0	*	*	Left	WRITE0
MOVE1	*	*	Left	WRITE1
WRITE0	1	0	Left	WRITE1
WRITE0	0	0	Left	WRITE0
WRITE1	1	1	Left	WRITE1
WRITE1	0	1	Left	WRITE0
WRITE0	*	0	Left	PACK
WRITE1	*	1	Right	PACK
PACK	*	*	No move	HALT

1.3 Problem 22

Approach 1: Ask him/her Which number is equal to one plus one. If he/she say two then he/she is a truth teller, otherwise he/she is a liar.

Approach 2: Ask him/her to write down the answer of "Which person are you, a truth teller or a liar?" on a paper, then tell you the words written on it. As a result, what he told you is the identity of him.

1.4 Problem 24

The halting problem shows that there are some problems that couldn't be solved by machines, which means the capabilities of machines is limited.

1.5 Problem 25

During we asking all the people, there exists at least people answering that his/her birthday is on that day.

After we asking all the people, there wasn't any people answering that his/her birthday is on that day.

We can enumerate all the positive numbers from 0 to bigger, if there exists some number we wanted, we will find it eventually. However, the time of this algorithm may be infinite.

I think we can't solve this problem.

1.6 Problem 32

1.7 Problem 35

"Select three numbers between 1 and 100." is nondetermin.

"Select one of the chosen numbers and give that number as the answer" is nondetermin.

1.8 Problem 36

The algorithm has a poly-nomial complexity.Because "Pick a collection of numbers" will take at last $O(n)$ time and check if the sum of these numbers is equal to 125 takes also $O(n)$ time. So the total complexity of the algorithm is $O(n)$.

1.9 Problem 43

Polynomial problems: Sorting an list of numbers Nonpolynomial problems: Travelling salesman problem Unsolvable problems: The Halting problem

1.10 Problem 45

The answer is "257, 771, 391, 304".

My algorithm is to enumerate all the subset of the list and check if their sum is equal to 1723. The complexity is $O(2^n * n)$.

1.11 Problem 50

The private key is 43.

In this case, n is small enough to find $p = 7$ and $q = 11$ so that $p*q = n$ in a $O(n)$ time. After that, we can find the private key d which satisfys $d * e = k(p-1)(q-1)+1$ with a extended-Euclidean Algorithm.

2 Chapter 6

2.1 Problem 4

Suppose the variable X is tored in the memory cell whose address is 1A, while Y is 1B, and Z 1C, W 1D.

```
2000
111A
121B
131D
B10E
5412
B010
5423
341C
C000
```

2.2 Problem 22

```
CASE W IS
   WHEN 5=> Z:=7;
   WHEN 6=> Y:=7;
   WHEN 7=> X:=7;
END CASE;
```