While you are allowed to discuss course material and general solution strategies with classmates, you may not use other resources (e.g. searching online), and you must work alone when formulating and writing up your solutions (refer to the syllabus for the full details on homework policies). When a problem asks for an algorithm, to receive full credit you must: (a) design an efficient algorithm, i.e. one with good runtime; (b) prove the algorithm’s correctness; and (c) analyze the running time of the algorithms. Partial credit is possible though, so please provide whatever solution you arrive at even if it is not as efficient as it might be, or is incomplete but provides some insight into the problem’s structure. The first and second parts of this homework will be released separately; however, they will be considered a single unit in the grade sheet. The main implication of this is that they combined weight of parts 1 and 2 will be the same as a normal homework, and that if your combined scored on homework three parts 1 and 2 is your lowest homework grade then both parts will be dropped.

Please write solutions neatly or typeset them, and staple your work together.

1. (20 points) Exercise 6.14 from the text, both parts. The point split is: 6 points for part a / 14 points for part b.

2. (20 points) Solve the attached programming problem. Vahid will send out an email detailing what you are expected to submit, and how you will be graded.
A multiplication game

Stan and Ollie play the game of multiplication by multiplying an integer \( p \) by one of the numbers 2 to 9. Stan always starts with \( p = 1 \), does his multiplication, then Ollie multiplies the number, then Stan and so on. Before a game starts, they draw an integer \( 1 < n < 4294967295 \) and the winner is who first reaches \( p \geq n \).

**Input and Output**

Each line of input contains one integer number \( n \). For each line of input output one line either

Stan wins.

or

Ollie wins.

assuming that both of them play perfectly.

**Sample input**

```
162
17
34012226
```

**Sample Output**

```
Stan wins.
Ollie wins.
Stan wins.
```