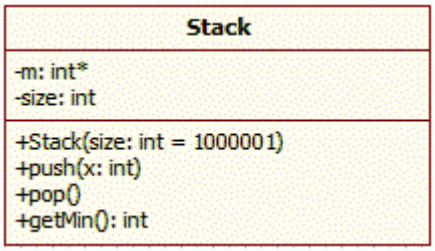
4259. Minimum in the stack

Implement a data structure with the next operations:

1. Push x to the end of the structure.
2. Pop the last element from the structure.
3. Print the minimum element in the structure.



Input. First line contains number of operations n ($1 \le n \le 10^6$). Next n lines contain the operations itself. The i-th line contains number t_i – the type of operation (1 in the case of ***push*** operation, 2 in the case of ***pop***, 3 if the operation demands to find minimum). In the case of push operation next goes integer x ($-10^9 \le x \le 10^9$) – element to be inserted into the structure. It is guaranteed that before each pop or ***getMin*** operation the structure is not empty.

Output. For each ***getMin*** operation print in a separate line one number – the minimal element in the structure.

Sample input	**Sample output**
8 1 2 1 3 1 -3 3 2 3 2 3	-3 2 2

SOLUTION

stack

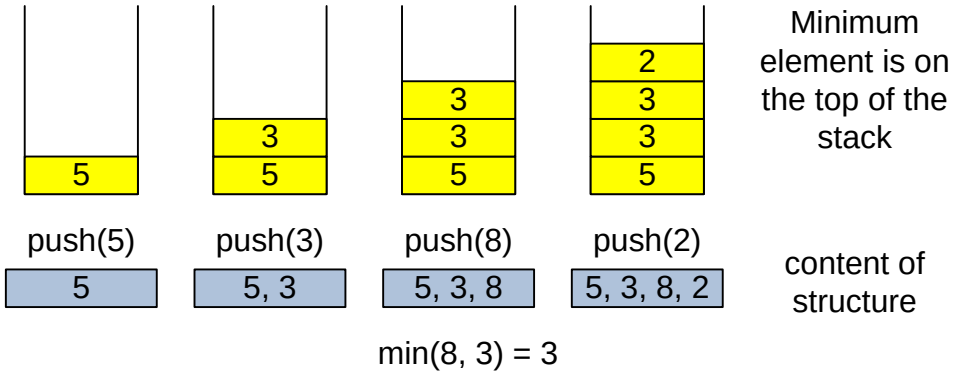
Algorithm analysis

Obviously, the required data structure is the **stack**. Since the number n of operations with stack is no more than 10^6, we will choose a static array of the specified length as its container.

The **pop**() method will be modeled as usual by removing the top element of the stack, and the **push**(x) method will be rewritten as follows:

- If stack is empty, ***push*** *x* to the stack;
- Otherwise, ***push*** to the stack the minimum between *x* and the current value of its top.

Thus, the minimum element of the stack will always be at the top. At the same time, we lose the values pushed onto the stack, although in reality they are not needed for further requests.



min(8, 3) = 3

When we process number 8, we push min (8, 3) = 3 at the top of the stack.

Algorithm realization

Declare class **Stack** and its methods.

```
class Stack {
public:
  Stack(int size);
  void push(int x);
  void pop();
  int getMin();
private:
  int* m;
  int size;
};

Stack::Stack(int size = 1000001) {
  m = new int[size];
  this->size = 0;
}

void Stack::push(int x) {
  if (size == 0)
    m[size++] = x;
  else
  {
    int pos = size - 1;
    m[size++] = min(x,m[pos]);
  }
}

void Stack::pop() {
  size--;
}

int Stack::getMin() {
```

```
  return m[size-1];
}
```

The main part of the program. Simulate the stack.

```
Stack s;

scanf("%d",&n);
while(n--)
{
  scanf("%d",&op);
  if (op == 1)
  {
    scanf("%d",&x);
    s.push(x);
  } else
  if (op == 2)
  {
    s.pop();
  } else
  {
    printf("%d\n",s.getMin());
  }
}
```

Algorithm realization – Stack STL

```
#include <cstdio>
#include <stack>
using namespace std;

int min(int a, int b)
{
  return (a < b) ? a : b;
}

int main(void)
{
  stack<int> s;
  int n, op, x;

  scanf("%d",&n);
  while(n--)
  {
    scanf("%d",&op);
    if (op == 1)
    {
      scanf("%d",&x);
      if (s.empty())
        s.push(x);
      else
        s.push(min(s.top(),x));
    } else
    if (op == 2)
    {
      s.pop();
    } else
```

```
    {
      printf("%d\n",s.top());
    }
  }
  return 0;
}
```

Java realization – Scannner

```
import java.util.*;
//import java.io.*;

public class Main
{
  public static void main(String[] args) // throws IOException
  {
    Scanner con = new Scanner(System.in);
    //Scanner con = new Scanner(new FileReader ("4259.in"));
    Stack<Integer> s = new Stack<Integer>();

    int n = con.nextInt();
    while(n-- > 0)
    {
      int op = con.nextInt();
      if (op == 1)
      {
        int x = con.nextInt();
        if (s.empty())
          s.push(x);
        else
          s.push(Math.min(s.peek(),x));
      } else
      if (op == 2)
      {
        s.pop();
      } else
      {
        System.out.println(s.peek());
      }
    }
    con.close();
  }
}
```

Java realization – Fast Scannner

```
import java.util.*;
import java.io.*;

public class Main
{
  public static void main(String[] args) //throws IOException
  {
    //FastScanner con = new FastScanner(new FileReader ("4259.in"));

    FastScanner con =
      new FastScanner(new InputStreamReader(System.in));
```

```
    Stack<Integer> s = new Stack<Integer>();

    int n = con.nextInt();
    while(n-- > 0)
    {
      int op = con.nextInt();
      if (op == 1)
      {
        int x = con.nextInt();
        if (s.empty())
          s.push(x);
        else
          s.push(Math.min(s.peek(),x));
      } else
      if (op == 2)
      {
        s.pop();
      } else
      {
        System.out.println(s.peek());
      }
    }
  }
}

class FastScanner
{
  private BufferedReader br;
  private StringTokenizer st;

  public FastScanner(InputStreamReader reader)
  {
    br = new BufferedReader(reader);
  }

  public String next()
  {
    while (st == null || !st.hasMoreTokens())
    {
      try
      {
        st = new StringTokenizer(br.readLine());
      } catch (Exception e)
      {
        e.printStackTrace();
      }
    }
    return st.nextToken();
  }

  public int nextInt()
  {
    return Integer.parseInt(next());
  }

  public double nextDouble()
  {
    return Double.parseDouble(next());
```

```
  }

  public void close() throws Exception
  {
    br.close();
  }
}
```