

# C++ 11

Friday, March 24, 2023 8:33 PM

C++

11. March 25
12. April 1
13. April 8
14. April 15
15. April 22 FINAL EXAM

{  
 obj i()  
 obj f(20)  
 d++ --f;  
 for (int i = 0; i < 10; ++i)  
 {  
 }  
 }

Works 3

→ obj  
 -i [0]  
 d [20]

Post-incr  
 C++  
 pre

-3  
+4

{

int i = 75  
int j = 85

Obj i(75)  
Obj j(85)

++i;

++i;

i++;

i++

--i;

--i;

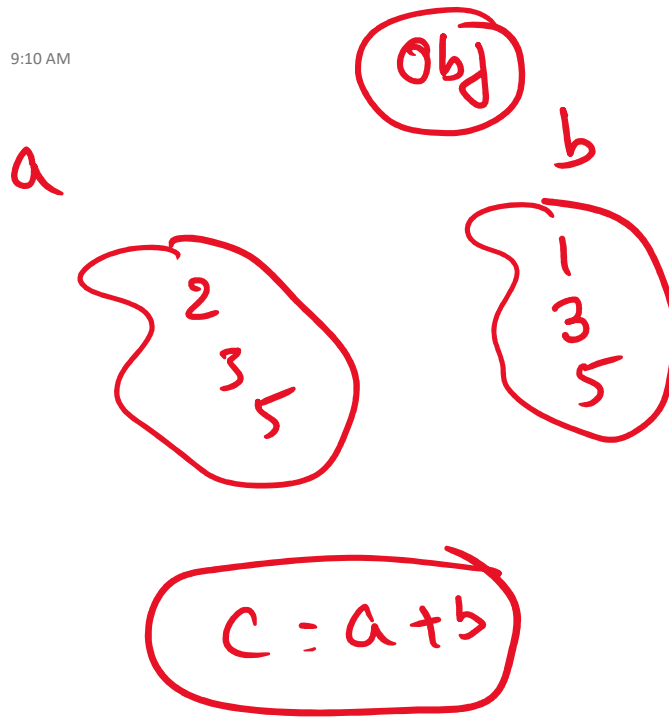
i--

i--

3

for (i = -20; i < 20; ++i) {  
Obj(i) arr[i] ( )

195896



Class Set {  
    Union

3;  
 $c = a + b$



and the elements will be between 0 to 63

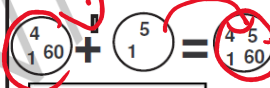
**1**  
Adding an element to set  
 $a = \{1, 2\}$   
 $a += 5 = \{1, 2, 5\}$   
 $a += \{10, 63\} = \{0, 1, 2, 5, 63\}$

**2**  
Removing an element  
 $a = \{1, 6, 10\}$   
 $a -= 6 = \{1, 10\}$

#### What to submit?

1. iset64test.cpp cannot be modified. All tests must pass
2. Submit as a hardcopy
  1. iset64.h
  2. iset64.cpp
3. Output as a pdf file
4. A word doc that explains
  1. Data structure used
  2. Algorithms used for all the 6 methods above

**3**  
Union of sets  
(overload with +)



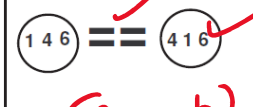
**4**  
Intersection of sets  
(overload with \*)



**5**  
Difference of sets  
(overload with -)



**6**  
Is set equal?  
(overload ==)



$(a == b)$

Class Set?

$a = \{1, 2, 3\}$

$a += 5$

$a += 2$

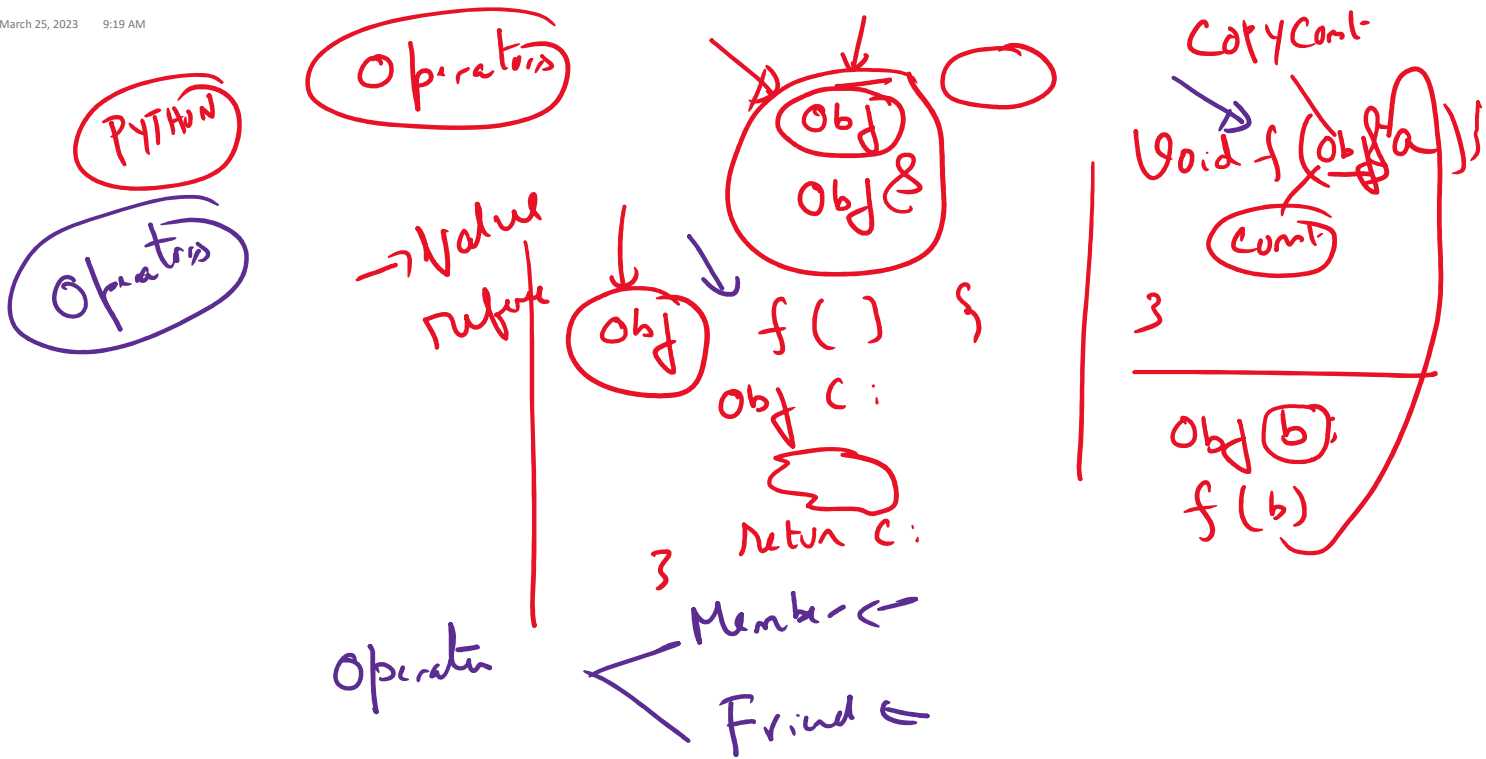
$(+)$

$a = a + b$

$a -= 1$

$(*)$

Cont- < c a c c  
 $\{1, 3, 5\}$



```
class Int {  
private:  
    int _d ;  
    char* _s;  
    static bool _display ;  
};
```

Int x(-234) :



(4)

x++

(3)  
-234

x[2] = (3)

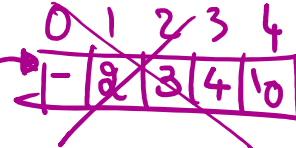
Int x = -234  
x[2]

{  
}  
}

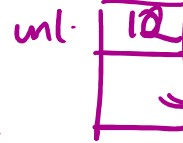
int x = 10;

int\* y = new int(20);  
delete y;

Int x = 10



STACK



Int

Heap



Heap  
0 1 2  
1 2 6

Int-

(2 to 100)

Int2

private:

//Private Data

int \_d;

char\* \_s;

static bool display;

//Private functions

void \_build\_string();

void \_alloc(int l) { s = new char[l]; }

void \_release() { delete[] \_s; }

void \_copy(const Int2&amp; rhs);

Int2\* \_this() { return this; }

};

FALSE

Int 2

d

25

100

250

True

STL

make.un

[ ]

=9758979

- 0

numdigit + 1

Int 2 a(999);

Int2\* b = new Int2(9513576);

a++

999+1: 1000

1000  
9990 1 2 3  
9 9 9 9

malloc

0 1 2 3 4 5  
0 1 0 0 0 0



```
Int2& operator++();
friend Int2& operator++(Int2& b);
```

int y = 100;  
int a = 45;

int y = ++a;

++a;

Int y = ++a;

@ 46

45 46

a + 5

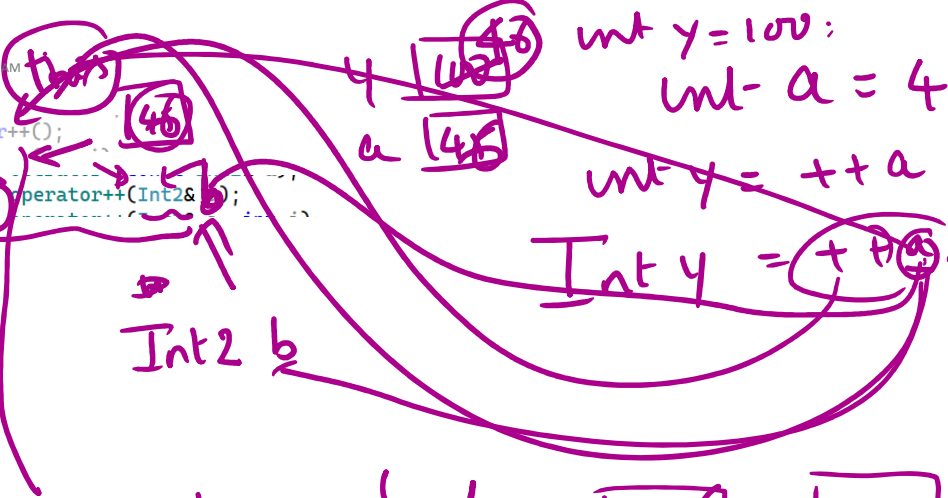
Membr  
( )  
①

friend  
1  
2

45  
a

40

|



```
/* + operator */
Int2 operator+(const Int2& b) const;
```

```
friend Int2 operator(const Int2& a, const Int2& b);
```

Object

\*1. ~

C

0

FRM

( )

(1)

(2)

F  
1  
2  
3

This

+

int a = 20;

int b = 40

int c = a + b

```

class Int2 {
public:
    Int2(int x = 0);
    Int2();
    Int2(const Int2& x);
    Int2& operator=(const Int2& x);
#ifdef MOVECONSTRUCTOR
    Int2(Int2&& b); // Move constructor
#endif
#ifdef MOVEEQUALOPERATOR
    Int2& operator=(Int2&& b);
#endif
    int num_digit() const { return int(strlen(_s)); }
    const char& operator[] (int index) const;
    friend ostream& operator<<(ostream& o, const Int2& x);
    static void set_verbose(bool x) { _display = x; }
}

```

Handwritten notes and annotations:

- $x(y)$  with an arrow pointing to `Int2(const Int2& x);`
- $x == y$  with an arrow pointing to `Int2& operator=(const Int2& x);`
- $ST_0$  in a circle with an arrow pointing to `Int2()`
- $[ ]$  with an arrow pointing to `operator[]`
- $cout << \_\_$  with an arrow pointing to `operator<<`
- Arrows pointing to `const` in `Int2(const Int2& x);` and `const char& operator[] (int index) const;`
- Arrows pointing to `Int2&` in `Int2& operator=(const Int2& x);` and `Int2& operator=(Int2&& b);`
- Arrows pointing to `static void` in `static void set_verbose(bool x) { _display = x; }`

```

/* unary operators as member fu
Int2 operator+() const;
Int2 operator-() const;
Int2& operator+();
Int2 operator++(int i);
Int2& operator--();
Int2 operator--(int i);
Int2 operator~() const;
bool operator!() const;
Int2* operator&();

```

Handwritten notes and annotations:

- $t = 50$  with an arrow pointing to `Int2 operator+() const;`
- $x = 50$  with an arrow pointing to `Int2 operator-() const;`
- $y = -50$  with an arrow pointing to `Int2& operator+();`
- $y = -x$  with an arrow pointing to `Int2 operator++(int i);`
- $x = 50$  with an arrow pointing to `Int2& operator--();`
- $x = 50$  with an arrow pointing to `Int2 operator--(int i);`
- $x = 50$  with an arrow pointing to `Int2 operator~() const;`
- $x = 50$  with an arrow pointing to `bool operator!() const;`
- $x = 50$  with an arrow pointing to `Int2* operator&();`

$x = 50$   
 $y = 10$   
 $y = ++x$   
 $x = 51$   
 $y = 51$

$x = 50$   
 $y = 10$   
 $y = x++$   
 $y = 50$   
 $x = 51$

$x = 50$   
 $++x$   
 $51$

$x = 50$   
 $x++$   
 $51$

$unt: x = 20$   
 $if (x) \{$   
 $\rightarrow$   
 $\}$   
 $else \{$   
 $\rightarrow$   
 $\}$

$\pi$ -Value

## NO HANDLE

```

16  =Int2 operator+(const Int2& x){
17      Int2 r(x);
18      return r;
19  }
20
21

```

Handwritten notes on the slide:

- Red circles around `Int2` and `x` in line 16.
- Red 'X' over `return r` in line 18.
- Red text: `ref r-val` with an arrow pointing to the `r` in line 18.
- Purple text: `LV` with an arrow pointing to the `x` in line 16.

LVAL

```
T yy = +x; //calls MOVECONSTRUCTOR
```

$$\text{uml. } x = 75$$
$$\text{uml. } y = +x$$

$y = 75$

$$x =$$

Wkt.  $x = 15$ :

$$w_1 - y = x:$$

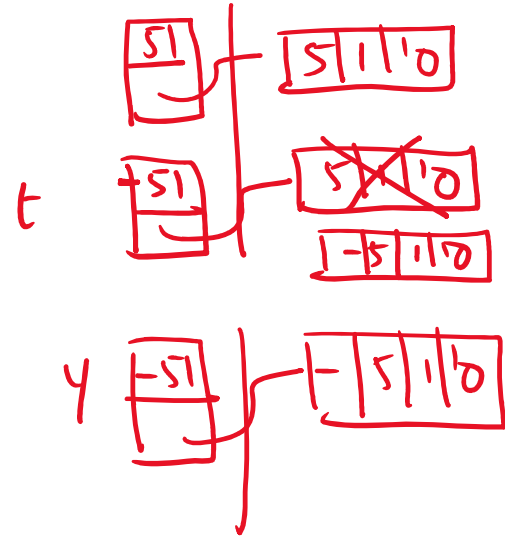
$(+i) \times u$

Std :: mod

$y(x)$ : ~~phase~~  
Cpy

$$\text{wrt } x = 75$$
$$\text{wrt } y = 85$$

$x = y$ ; Equa

$$x = 51$$


$$\text{url-}y = (-x)$$

**Friend function**

```

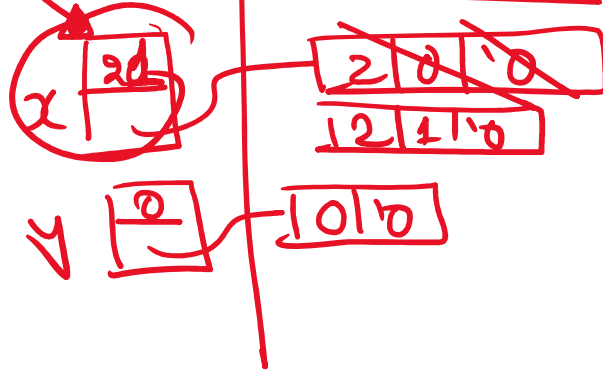
// ...
Int2& operator++(Int2& x) {
    ++(x._d);
    x._release();
    x._build_string();
    return x;
}

```

```

// ...
P("07. x", x);
{
    T y = 0;
    P("08. y = ++x", y = ++x);
    P("08A. y", y);
}

```



```

P("10. x", x);
{
    T y = 0;
    P("11. y = x++", y = x++); //calls MOVECONSTRUCTOR + MOVEEQUALOPERATOR operator
    P("11A. y", y);
}
P("12. x", x);
P("13. y", y);

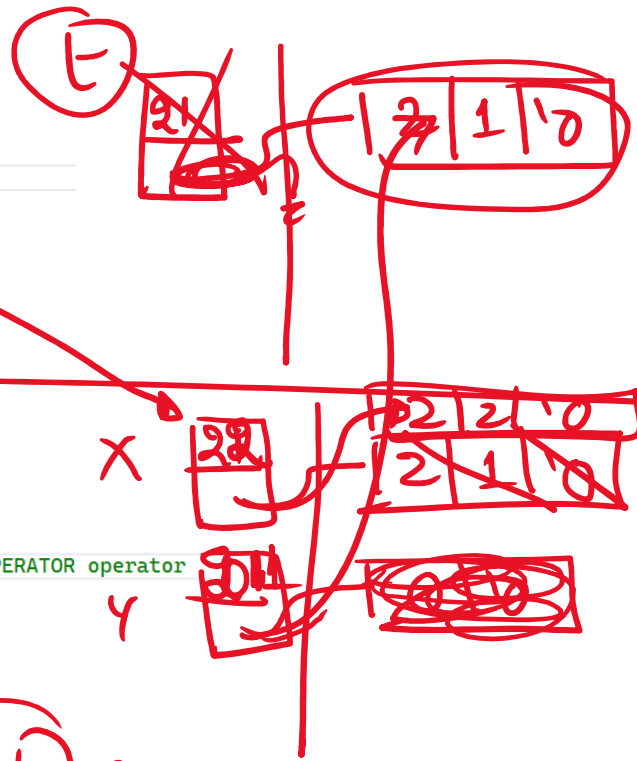
```

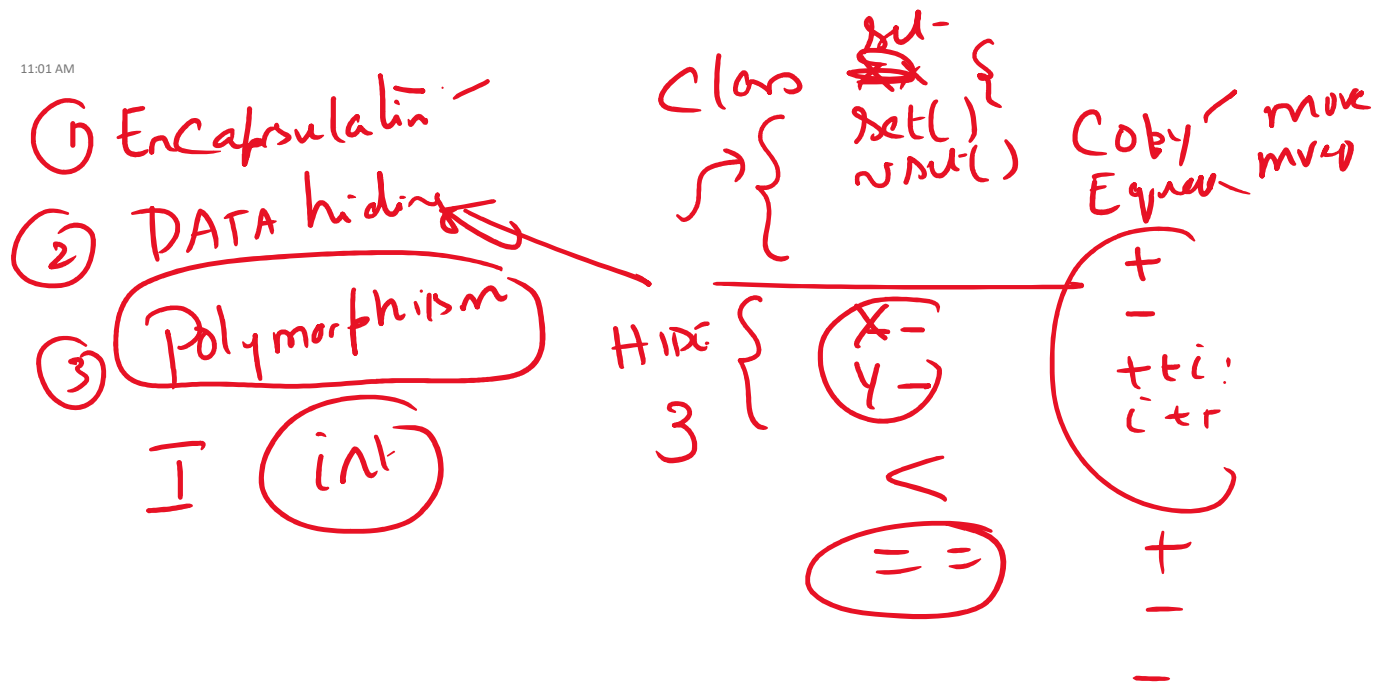
Handwritten notes on the right side of the image:

- $y = 21$
- $x = 22$
- $x$
- $y$

4

Recurs

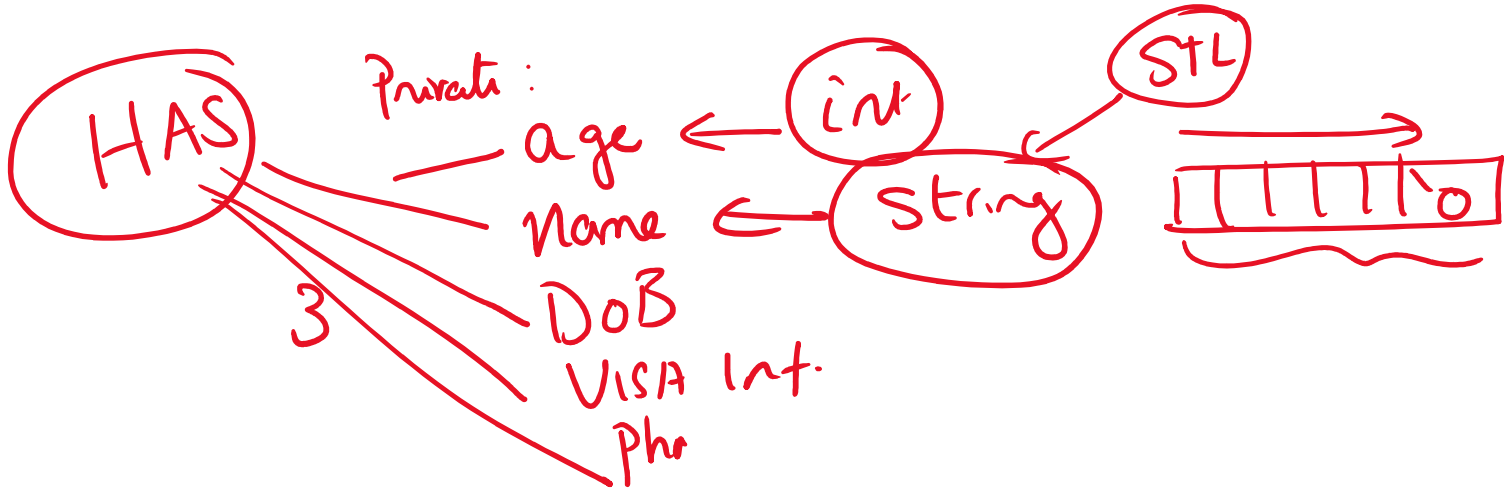






Class Student {

Composition  
↳ inheritance



IS ~~HAS~~ STUDENT HAS

HAS  
Age  
name  
Phone  
address  
count

Composition

111 Page 18

<https://www.agame.com/game/deal-or-no-deal-iwin>



$N = 40$

## Deal or No deal

(T) (Luty) HAS 26 Su. 100  
 HAS 7, 6  
 1 strong 1 milli  
 HAS — BANKER  
 HAS — PLAY  
 1 mil (Swk)  
 [25] [ ]

class dealer node class

~~27~~ 27  
50

oop

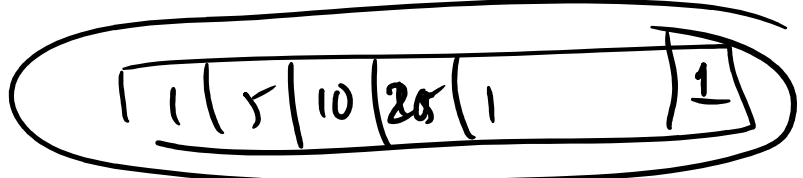
1\$  
5\$

shuffle

Suitcase

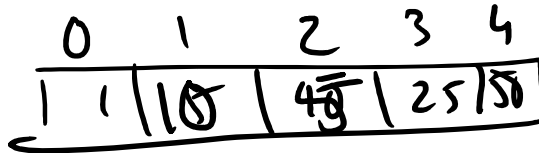
...

3



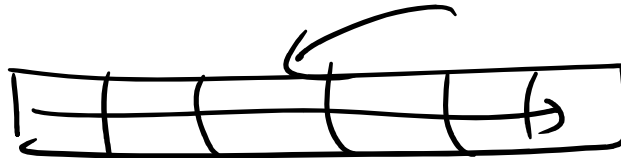
log

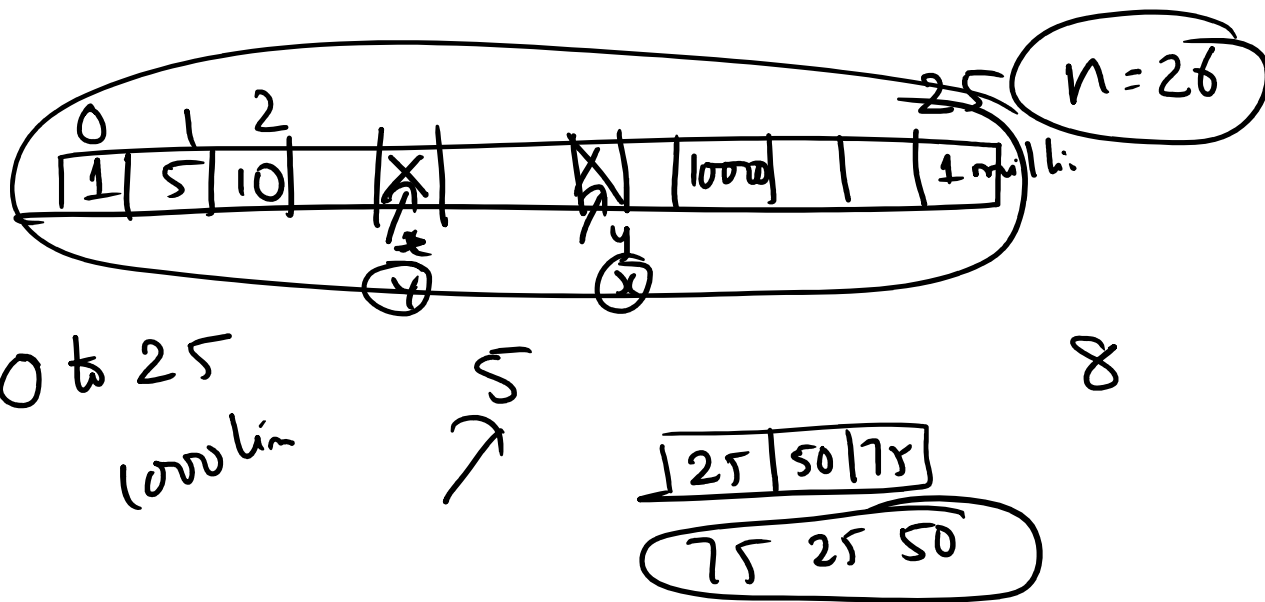
25-  
1



n=5

0...4



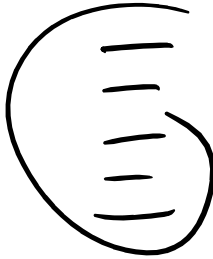


{7, 8, 4, 3, 1, 1, 1}

No deal

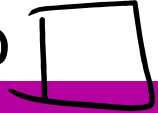


Less



Pranab.

20



```

Interactive[i] or Computer[c] : n
Interactive[i] or Computer[c] : i
Select ONE suitcase from 1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26
Select ONE suitcase from above: 37
Select ONE suitcase from above: tyy
Select ONE suitcase from above: 20
Your suitcase is: 20
-----ROUND NUMBER 1-----
***Select 6 suitcases now***
Select ONE suitcase from 1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,21,22,23,24,25,26
Select ONE suitcase from above: 11
You selected suitcase 11 which has 10000 dollars
Select ONE suitcase from 1,2,3,4,5,6,7,8,9,10,12,13,14,15,16,17,18,19,21,22,23,24,25,26
Select ONE suitcase from above: 25
Select ONE suitcase from above: 25
You selected suitcase 25 which has 200 dollars
Select ONE suitcase from 1,2,3,4,5,6,7,8,9,10,12,13,14,15,16,17,18,19,21,22,23,24,26
Select ONE suitcase from above: 18
You selected suitcase 18 which has 5 dollars
Select ONE suitcase from 1,2,3,4,5,6,7,8,9,10,12,13,14,15,16,17,19,21,22,23,24,26
Select ONE suitcase from above: 14
You selected suitcase 14 which has 1 dollars
Select ONE suitcase from 1,2,3,4,5,6,7,8,9,10,12,13,15,16,17,19,21,22,23,24,26
Select ONE suitcase from above: 10
You selected suitcase 10 which has 1000 dollars
Select ONE suitcase from 1,2,3,4,5,6,7,8,9,12,13,15,16,17,19,21,22,23,24,26
Select ONE suitcase from above: 16
You selected suitcase 16 which has 10 dollars
Money left are: 1000,100,500000,75000,100000,100,3000,10,75,50,750,25,400,20000,75000,0.01,400000,500,25000,50000
Banker offer: 179063
Deal[d] or NOdeal[n] :

```

Exhibit-20

10000

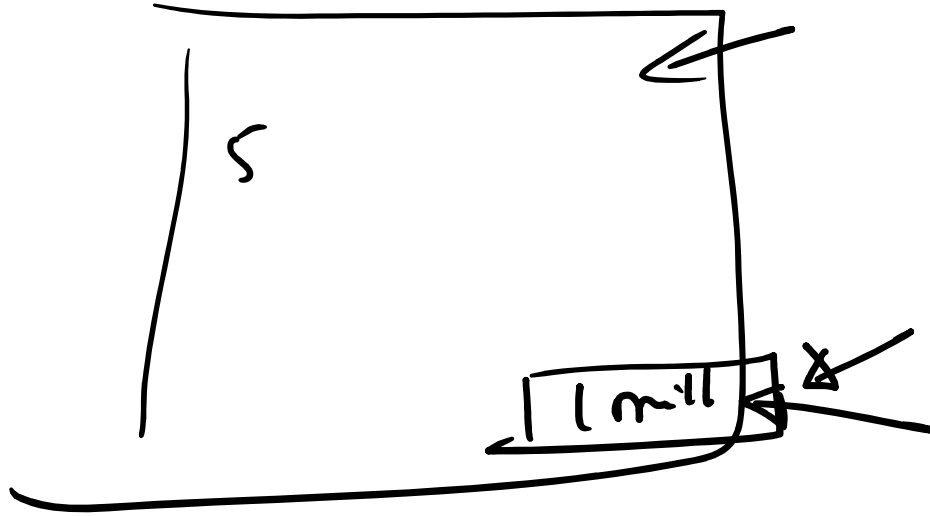
6

Average

179K



NBC



```

Interactive[i] or Computer[c] :n
Interactive[i] or Computer[c] :i
Select ONE suitcase from 1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26
Select ONE suitcase from above: 37
Select ONE suitcase from above: tyy
Select ONE suitcase from above: 20
Your suitcase is: 20
-----ROUND NUMBER 1 -----
***Select 6 suitcases now***
Select ONE suitcase from 1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,21,22,23,24,25,26
Select ONE suitcase from above: 11
You selected suitcase 11 which has 10000 dollars
Select ONE suitcase from 1,2,3,4,5,6,7,8,9,10,12,13,14,15,16,17,18,19,21,22,23,24,25,26
Select ONE suitcase from above: 2io
Select ONE suitcase from above: 25
You selected suitcase 25 which has 200 dollars
Select ONE suitcase from 1,2,3,4,5,6,7,8,9,10,12,13,14,15,16,17,18,19,21,22,23,24,26
Select ONE suitcase from above: 18
You selected suitcase 18 which has 5 dollars
Select ONE suitcase from 1,2,3,4,5,6,7,8,9,10,12,13,14,15,16,17,19,21,22,23,24,26
Select ONE suitcase from above: 14
You selected suitcase 14 which has 1 dollars
Select ONE suitcase from 1,2,3,4,5,6,7,8,9,10,12,13,15,16,17,19,21,22,23,24,26
Select ONE suitcase from above: 10
You selected suitcase 10 which has 1000 dollars
Select ONE suitcase from 1,2,3,4,5,6,7,8,9,12,13,15,16,17,19,21,22,23,24,26
Select ONE suitcase from above: 16
You selected suitcase 16 which has 10 dollars
Money left are: 1e+06,100,500000,75000,100000,300,300000,75,50,750,25,400,200000,750000,0.01,400000,500,25000,50000
Banker offer: 179063
Deal[d] or NOdeal[n] :

```

## 23 (automatic)

Saturday, March 25, 2023 11:49 AM

Interactive[i] or Computer[c] :c

Select ONE suitcase from 1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26

Your suitcase is: 13

-----ROUND NUMBER 1 -----

\*\*\*Select 6 suitcases now\*\*\*\*

Select ONE suitcase from 1,2,3,4,5,6,7,8,9,10,11,12,14,15,16,17,18,19,20,21,22,23,24,25,26

You selected suitcase 1 which has 500 dollars

Select ONE suitcase from 2,3,4,5,6,7,8,9,10,11,12,14,15,16,17,18,19,20,21,22,23,24,25,26

You selected suitcase 18 which has 75 dollars

Select ONE suitcase from 2,3,4,5,6,7,8,9,10,11,12,14,15,16,17,19,20,21,22,23,24,25,26

You selected suitcase 11 which has 500000 dollars

Select ONE suitcase from 2,3,4,5,6,7,8,9,10,12,14,15,16,17,19,20,21,22,23,24,25,26

You selected suitcase 15 which has 100 dollars

Select ONE suitcase from 2,3,4,5,6,7,8,9,10,12,14,16,17,19,20,21,22,23,24,25,26

You selected suitcase 2 which has 0.01 dollars

Select ONE suitcase from 3,4,5,6,7,8,9,10,12,14,16,17,19,20,21,22,23,24,25,26

You selected suitcase 6 which has 300 dollars

Money left are:

5000,400,1,100000,400000,25000,25,750000,750,200000,300000,1e+  
06,50000,200,75000,50,1000,10000,5 SORT

Banker offer: 153549

-----ROUND NUMBER 2 -----

\*\*\*Select 5 suitcases now\*\*\*\*

Select ONE suitcase from 3,4,5,7,8,9,10,12,14,16,17,19,20,21,22,23,24,25,26

You selected suitcase 10 which has 25 dollars

Select ONE suitcase from 3,4,5,7,8,9,12,14,16,17,19,20,21,22,23,24,25,26

You selected suitcase 14 which has 750 dollars

Select ONE suitcase from 3,4,5,7,8,9,12,16,17,19,20,21,22,23,24,25,26

You selected suitcase 26 which has 5 dollars

Select ONE suitcase from 3,4,5,7,8,9,12,16,17,19,20,21,22,23,24,25

You selected suitcase 9 which has 25000 dollars

Select ONE suitcase from 3,4,5,7,8,12,16,17,19,20,21,22,23,24,25

You selected suitcase 3 which has 5000 dollars

Money left are: 400,1,100000,400000,750000,200000,300000,1e+06,50000,200,75000,50,1000,10000

Banker offer: 206189

-----ROUND NUMBER 3 -----

\*\*\*Select 4 suitcases now\*\*\*\*

Select ONE suitcase from 4,5,7,8,12,16,17,19,20,21,22,23,24,25

You selected suitcase 24 which has 1000 dollars

Select ONE suitcase from 4,5,7,8,12,16,17,19,20,21,22,23,25

You selected suitcase 20 which has 50000 dollars

Select ONE suitcase from 4,5,7,8,12,16,17,19,21,22,23,25

You selected suitcase 25 which has 10000 dollars

Select ONE suitcase from 4,5,7,8,12,16,17,19,21,22,23

You selected suitcase 17 which has 300000 dollars

Money left are: 400,1,100000,400000,750000,200000,1e+06,200,75000,50

Banker offer: 252565

-----ROUND NUMBER 4 -----

\*\*\*Select 3 suitcases now\*\*\*\*

Select ONE suitcase from 4,5,7,8,12,16,19,21,22,23

You selected suitcase 21 which has 200 dollars

Select ONE suitcase from 4,5,7,8,12,16,19,22,23

You selected suitcase 12 which has 750000 dollars

Select ONE suitcase from 4,5,7,8,16,19,22,23

You selected suitcase 16 which has 200000 dollars

Money left are: 400,1,100000,400000,1e+06,75000,50

Banker offer: 225064

-----ROUND NUMBER 5 -----

\*\*\*Select 2 suitcases now\*\*\*\*

Select ONE suitcase from 4,5,7,8,19,22,23

You selected suitcase 23 which has 50 dollars

Select ONE suitcase from 4,5,7,8,19,22

You selected suitcase 4 which has 400 dollars

Money left are: 1,100000,400000,1e+06,75000

Banker offer: 315000

-----ROUND NUMBER 6 -----

\*\*\*Select exactly one suite now\*\*\*

Select ONE suitcase from 5,7,8,19,22

You selected suitcase 19 which has 1e+06 dollars

6,5,4,3,2,1,1,1

94

99

15 show

94 show

-----ROUND NUMBER 6 -----

\*\*\*Select exactly one suite now\*\*\*

Select ONE suitcase from 5,7,8,19,22

You selected suitcase 19 which has 1e+06 dollars

Money left are: 1,100000,400000,75000

Banker offer: 143750

-----ROUND NUMBER 7 -----

\*\*\*Select exactly one suite now\*\*\*

Select ONE suitcase from 5,7,8,22

You selected suitcase 8 which has 400000 dollars

Money left are: 1,100000,75000

Banker offer: 58333

-----ROUND NUMBER 8 -----

\*\*\*Select exactly one suite now\*\*\*

Select ONE suitcase from 5,7,22

You selected suitcase 5 which has 1 dollars

Money left are: 100000,75000

Banker offer: 87500

-----ROUND NUMBER 9 -----

\*\*\*Select exactly one suite now\*\*\*

Select ONE suitcase from 7,22

You selected suitcase 22 which has 75000 dollars

Money left are: 100000

Banker offer: 100000

-----ROUND NUMBER 10 -----

Select ONE suitcase from 7

Last suitcase left is 7 which has 100000 dollars

Your suitcase has: 10 dollars

94 sho

1mill

Do, C

```
} int main() {  
    deal_or_nodeal::get_interactive_or_computer();  
    deal_or_nodeal::play_a_game();  
    deal_or_nodeal::play_until_millionaire();  
    deal_or_nodeal::play_until_bankrupt();  
    return 0 ;  
}
```

Handwritten annotations: A large curly brace on the left groups the four function calls. An arrow points from the word "Do" to the first line. An arrow points from the word "C" to the second line. The third line is underlined, and an arrow points from a circled "99" to it. A circle is drawn to the right of the "99".