Discussion 2

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   - Pointer
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1. CONST
   - Variable
   - Pointer
   - object
   - Member variable
2. Homework 1

const + variable

There are 2 methods.

```
const  TYPE var;
```

```
TYPE const var;
```

They are of the same meaning that *var* is constant.

const + pointer

There are 2 circumstances.

```
const TYPE* p;
```

```
TYPE* const p;
```

What are their meanings?

const + pointer (cont'd)

```
const int* p = &x;
```

The content of p is constant.

```
*p = 30;
```

It causes an error: assignment of read-only location '*p'

```
p = &y;
```

It does work because the pointer p is simple pointer.

const + pointer (cont'd)

```
int* const p = &x;
```

The pointer *p* is constant.

```
*p = 30;
```

It works because the content is not constant.

```
p = &y;
```

It causes an error: assignment of read-only variable 'p'

const + object

It means that the object is constant. None of the data members can be modified. Only *const* member function can be called. Constant objects must be initialized.

```
class A
{
...
void func1();
void func2{} const;
...
}
const A b;
```

```
b.func1();
```

causes an error.

const + object (cont'd)

It means that the object is constant. None of the data members can be modified. Only *const* member function can be called. Constant objects must be initializedi.

```
class A
{
...
void func1();
void func2{} const;
...
}
const A b;
```

```
b.func2();
```

works.

const + member variable

Constant member variable of class must be assigned in initialization list.

```
class A
{
...
const int val;
...
A(int x): val(x);
...
}
```

1 CONST

2 Homework 1

- PROBLEM 1
- PROBLEM 3
- PROBLEM 4
- PROBLEM 5

PROBLEM 1

SOLUTION 1.1

Binary search

SOLUTION 1.2

Number of guesses in the worst case is m.

SOLUTION 1.3

Probability of each number is $1/N$. There are 1 number that needs 1 guess, 2 numbers that need 2 guesses, ..., 2^{m-1} numbers that need m guesses. So the average number of guesses is

$$\frac{1}{N}\sum_{k=1}^{m} k \times 2^{k-1} = m - 1 + \frac{m}{2^m - 1}$$

PROBLEM 3

SOLUTION

$$c_1 g_1 \leq f_1 \leq d_1 g_1$$

$$c_2 g_2 \leq f_2 \leq d_2 g_2$$

$$h = max(g_1, g_2) \leq g_1 + g_2$$

Let $c = min(c_1, c_2)$, then

$$ch \leq c(g_1 + g_2) \leq c_1 g_1 + c_2 g_2 \leq f_1 + f_2$$

Let $d = d_1 + d_2$, then we have

$$f_1 + f_2 \leq d_1 g_1 + d_2 g_2 \leq (d_1 + d_2)h = dh$$

Thus,

$$ch \leq f \leq dh$$

PROBLEM 4

SOLUTION

$$\sum_{i=0}^{\lfloor \log_a n \rfloor} ba^i = b\frac{a^{\lfloor \log_a n \rfloor + 1} - 1}{a - 1}$$

PROBLEM 5.1

SOLUTION 5.1

$$T_1(n) = \lceil \frac{n}{2} \rceil$$

$$T_2(n) = \lceil \frac{n}{20} \rceil$$

$$T_3(n) = \lceil \log_2 n \rceil + 1$$

PROBLEM 5.2

SOLUTION 5.2

$$C_1(n) = 2\lceil \frac{n}{2} \rceil + 4n$$

$$C_2(n) = 10 + \lceil \frac{n}{20} \rceil + 4n$$

$$C_3(n) = 40 + 2(\lceil \log_2 n \rceil + 1) + 4n$$

PROBLEM 5.3

SOLUTION 5.3

$$C_1(8) = 40$$

$$C_2(8) = 43$$

$$C_3(8) = 80$$

The cheapest is Method 1.

PROBLEM 5.4

SOLUTION 5.4

$$C_1(128) = 640$$

$$C_2(128) = 529$$

$$C_3(128) = 568$$

The cheapest is Method 2.

PROBLEM 5.5

SOLUTION 5.5

$$C_1(2048) = 10240$$

$$C_2(2048) = 8305$$

$$C_3(2048) = 8256$$

The cheapest is Method 3.