Class -7

Data types

① int → 4 byte → 32 bit
- → 31 binary values
- → 1 sign bit $[+/-]$

② 2^{31} [2147483648]
- → + 2×10^9
- → - 2×10^9

Class-8

scanf, More Data-types, variables, Operators

④ [%0.10 f] This is the format.

④ float → 6, double 15 for precision.

⑤ at least one double to get fraction [15 × 1·0]

⑥ long long → 8 byte → $[-2^{63}, 2^{63}-1]$ → [lld]
$$[-9 \times 10^{18}, 9 \times 10^{18}]$$

Class 9

[short x; scanf ("%hd", &x);
→ 2 byte [-32768 to 32 767]]

④ aeb = $a \times 10^b$

⑤ Type casting → double = $a \times 1·0$
long long = $a \times 1LL$

① select c++20 on online judge

Class 10

Mod operation its cyclic pattern, Decimal, binary

※ atcode [abc + bac + cba] problem solve.

Ⓧ Bold comment = /// This is a comment.

Class 11

Assignment, Increment, Decrement Operation

post
incre.
$$a = 12;$$
$$b = a++;$$
$$a = 13, b = 12$$

post
decrement
$$a = 12$$
$$b = a--$$
$$a = 11, b = 12$$

pre
incre.
$$a = 12$$
$$b = ++a$$
$$a = 13, b = 13$$

pre
decre.
$$a = 12$$
$$b = --a$$
$$a = 11, b = 11$$

※ bool data type → size 1 byte

Negative Module

Ⓐ $-23 \% 5 = 2$
$$= 5 \times (-4) \Big\} -3 = -23$$
Now $\Rightarrow (-3 + 5) \neq 2$

Ⓑ $-37 \% 4 = 3$
$$= \{-9 \times (-9)\} -1 = -37$$
Now $\Rightarrow -1 + 4 = 3$

Proof :-

Quotient × Divisor + Remainder = Dividend
$$-10 \qquad \times \quad 4 \quad + \quad 3 \qquad = -37$$

Class 12

Bitwise Operations

i) Bitwise Operators: OR (|), AND (&), XOR (^)
ii) Patterns in XOR
iii) Google interview question with XOR.
iv) Codemarshal problems (5) [Problem in accessing codemarshal]

OR → 7 | 15

※ int a, b;
   scanf ("%d %d", &a, &b);
     int or = a | b; int and = a & b;

XOR → a ^ b

{ bit same 0
{ bit diff 1

[Odd times 1 means result 1
{ even   "   1   "   "   0

a	b	A&B
0	0	0
0	1	1
1	0	1
1	1	0

※ $a \wedge a = 0$; $a \wedge a \wedge a = a$
※ $[a, b, c, a, b] = a \wedge b \wedge c \wedge a \wedge b = c$.

※

Class 13

Conditions :-

$(n \& 1)$
- → if n is even then 0
- → if n is odd then 1

Class 14

practice on if else :-

Choices are $1, 2, 3$. Now two num will be given. need to find out third one.

Technic 1 :- $6 - a - b$

2 : $a \wedge b = c$

Swap two numbers :- (own)

$$\begin{cases} a = a + b \\ b = a - b \\ a = a - b \end{cases}$$

Class -15

Ⓐ How to think ab the scenerio not the test case

→ 2 problems solved

Class -16

Ⓐ Intro to loops

→ For & while.

Class 17

❋ Practice problems on loop

→ Vjudge (completed):

→ Do While

Joplin → Small to large (light OJ)
    → Str [i] - '0' (")

Class 18

❋ Nested loops

→ Software Design principle:
   KISS → Keep it simple Stupid

Class 19

❋ Practice problems on loop

Class 20   [.cpp have to use]

❋ Intro to Array
→ a[10^5] / a[100000] works locally
→ Static & Dynamic ~~array~~ memory.
   ⊙ a[10^7] works globally

→ Inside main() is Dynamic
   Outside main() is Static
→ const int n=2; [read only]
  n = 3 [not possible to change]

Class 21

※ Practice problems on Array

Array → Key : value

Key	:	value
0	:	111
1	:	10
2	:	50

[index]

② const int mx = 100123; ⎫ Outside main()
int arr[mx]; ⎬ function.
⎭ extension [.cpp]

※ Array reverse

Class 22

$A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$ 3×3

$(R_1 \times C_1)$

$B = \begin{bmatrix} 10 & 11 \\ 12 & 13 \\ 14 & 15 \end{bmatrix}$ 3×2

$(R_2 \times C_2)$

$\begin{pmatrix} 1 \times 10 \\ + \\ 2 \times 12 \\ + \\ 3 \times 14 \end{pmatrix}$ → one cell

$AB = \begin{bmatrix} 76 & 82 \\ 184 & 199 \\ 292 & 316 \end{bmatrix}$

Code :
```
for (i=0; i<R1; i++)
    for (j=0; j<C2; j++)
        for (k=0; k<R2; k++)
            result[i][j] += (arr1[i][k] * arr2[k][j]);
```

※ (C1=R2) compulsory.

⊛ a[5⁷][10⁷] can be declared globally
   It's the highest.

Class-23

② String & practice
   → for large string lengths, we have to declare it
   outside main function.
      ~~const int mx~~
      chars mx [100123];

   → ②   0   1   2   3   4   5
            a   b   c   d   e   f
            97 98 99 100 101 102
      | str[i] - 'a' = 'd' - 'a' = 100-97 = 3 |

Class 24

⊛ String practice and Char Grid

Ternary Operator : (Preferable in development)

   (condition) ? expression 1 : expression 2 ;

⊛ 1, 2, 3, 4, 5 → sub array/segment [2,3,4]
      → sub sequence [1,3,4]

⊛ Substring: A substring of a string is a contigous
      subsequence of the string.

⊛ Bruteforce.

Class 25

✱ Intro to Bruteforce & constructive algorithm

Joplin → Pythagoran problem added for the technique.

Class-26

✱ Intro to Greedy

✱ 0-1 Knapsack → can't be solved by greedy because it's without fraction.

✱ Every problem has bruteforce solution.

Class-27

Time & space Complexity analysis

1) $O(1)$ constant time complexity
2) $O(n)$ linear "
3) $O(n^2), O(n^3), O(\log(n))$
4) Polynomial & Exponential time complexity.

→ Computer process 10^8 tasks in $1s$.

→ $9n^2 + 3n + 2$ mm. of factor effect.

→ Polynomial time complexity → $O(n^a) [a=1,2,3...]$ It's good.

⊛ In 10^5 total decimal digits = $(\log_{10} 10^5) + 1$

  In 20 3 u binary n = $(\log_2 2^{30}) + 1$

⊛ $\log_2 (10^5) = 16 \cdot 6 = 17$ [binary digits]

⊛ total digits = $[\log_x (n) + 1]$

  Here, $x = 2, 10, 8, 6$, etc

⊛ digit calculation program → $O(\log_x n)$

⊛ binary search → $O(\log_2 n)$

⊛ exponential-time complexity → a^n
  → bit mask, mobius inversion, inculsion, exclos
       ↓ (num theory)   ↓ (combinatorics)

Class 28

Intro to User defined functions

⊛ If arr[] declared globally no need to send it to a function.

⊛ Array without index is a pointer.