Binary Search

case-1:

```
// lo=0, hi=mx ; // mx = maximum possible answer.
while (lo < hi) {   // lo=hi হলে loop break করবে।
    // mid = (lo+hi+1) >> 1;
    if (condition)          // valid condition, and ans can be mid or bigger than mid.
        lo = mid;
    else                    // invalid condition, ans is less than mid.
        hi = mid-1;
}
```

or, case-2:

```
while (lo < hi) {
    // mid = (lo+hi) >> 1;
    if (condition)          // valid condition
        hi = mid;           // ans can be mid or less than mid
    else
        lo = mid+1;         // ans is greater than mid.
}
```

e.g: lo = 1, hi = 8 → 1 2 3 4 5 6 7 8

for case-1: $mid = \frac{1+8}{2} = 4$, lo = 4, hi = 8 → 5 তম num

So, for case-I, $mid = (lo+hi+1) >> 1 = \frac{(1+8+1)}{2} = 5$, lo = 5, hi = 8

For floating number:

```
ld lo=0, hi= mx ; esp = maxError;
while ( hi - lo > esp ){
    ld mid = (lo + hi + esp)/2.0;
    if (condition)
        lo = mid ;
    else
        hi = mid - esp ;
}
```

previous :

while(lo < hi)

or while (hi - lo > 0) →

⟹ hi - lo = 0 হলেই loop break করবে।

same as before.

1 ⟶ এর জায়গায় esp.

or,

```
while ( hi - lo > esp ){
    ld mid = (lo + hi) /2.0;
    if(condition)
        hi = mid ;
    else
        lo = mid + esp ;
}
```