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Iterative Power (Binary Exponentiation)

Given an integer x and a positive number y , write a function that computes x^y under following conditions.

- Time complexity of the function should be $O(\log y)$
- Extra Space is $O(1)$

Examples:

Input: $x = 3, y = 5$
 Output: 243

Input: $x = 2, y = 5$
 Output: 32

The recursive solutions are generally not preferred as they require space on call stack and they involve function call overhead.

Following is implementation to compute x^y .

Python3

```

# Iterative Python3 program
# to implement pow(x, n)

# Iterative Function to
# calculate (x^y) in O(log y)
def power(x, y):

    # Initialize result
    res = 1

    while (y > 0):

        # If y is odd, multiply
        # x with result
        if ((y & 1) == 1) :
            res = res * x

        # y must be even
        # now y = y/2
  
```

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```
        y = y >> 1

        # Change x to x^2
        x = x * x

    return res

# Driver Code
x = 3
y = 5

print("Power is ",
      power(x, y))
```

Output:

Power is 243

Time Complexity: $O(\log y)$, since in loop each time the value of y decreases by half it's current value.

Auxiliary Space: $O(1)$, since no extra space has been taken.

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