Algorithm Design & Problem Solving: Some new



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What is Recursion?



When one function calls ITSELF directly or indirectly.

What is Recursion?



Different mode of thinking.

Powerful programming tool.

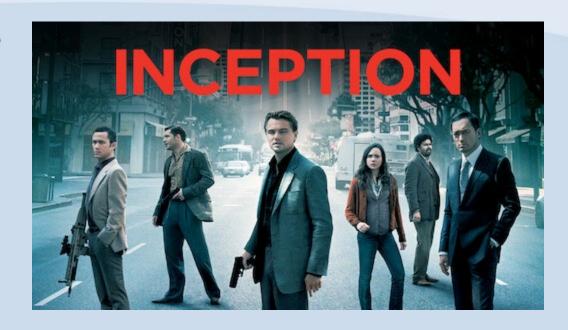
Divide-and-conquer paradigm.

What is Recursion?



Inception movie

function dream() print "Dreaming" dream() **End function**



Recursive Factorial



```
Factorial (n)
  if n=1 or n=0
        return 1
  else
        return n*Factorial(n-1)
```

```
Factorial (n)
fact=1
if n=1 or n=0
  return 1
else
for i=1 to n
         fact=fact*i;
   return fact
```

Recursive X ^ Y

```
Power(x,y)

if (y=0) then

return 1;

else

return x*Power(x,y-1);
```

```
Power (x, y)

ans=1

if y=0

return 1

else

for i=1 to y

ans=ans * x;

return ans
```

Calculate GCD >



Given 2 numbers, calculate the greatest common divisor.

What is "greatest common divisor"?

It is the largest number that is divisible in a set.

What does that mean??

GCD: An example



(4, 2) The GCD is 2. Why?

4/2 = 2, 2/2 = 1, rem=0 Correct

Calculating GCD



- **•** (9, 6)
- **•** (16, 4)
- **(20, 16)**

Now try this ...

(72, 32)

Calculating GCD

How can you calculate GCD if we are using very large numbers?

Use Euclid's Algorithm



Find GCD of (72, 32)

$$72, 32 \rightarrow 72/32 = 2 \text{ rem } 8$$

$$32, 8 \rightarrow 32/8 = 4 \text{ rem } 0$$

When rem=0, your divisor is GCD = 8



```
Find GCD of (84, 55)
```

```
84, 55 -> 84/55 = 1 rem 29

55, 29 -> 55/29 = 1 rem 26

29, 26 -> 29/26 = 1 rem 3

26, 3 -> 26/3 = 8 rem 2

3, 2 -> 3/2 = 1 rem 1

2, 1 -> 2/1 = 2 rem 0
```

When rem=0, divisor is GCD = 1



Write an algorithm to do this



GCD

(32, 8)

GCD

gcd(a, b)
if (b = 0) then
 return a
else
 return gcd(b, a mod b)

| GCD (72, 32) | |
|-----------------|--|
| GCD (32, 8) | |

