INDIAN INSTITUTE OF TECHNOLOGY MADRAS

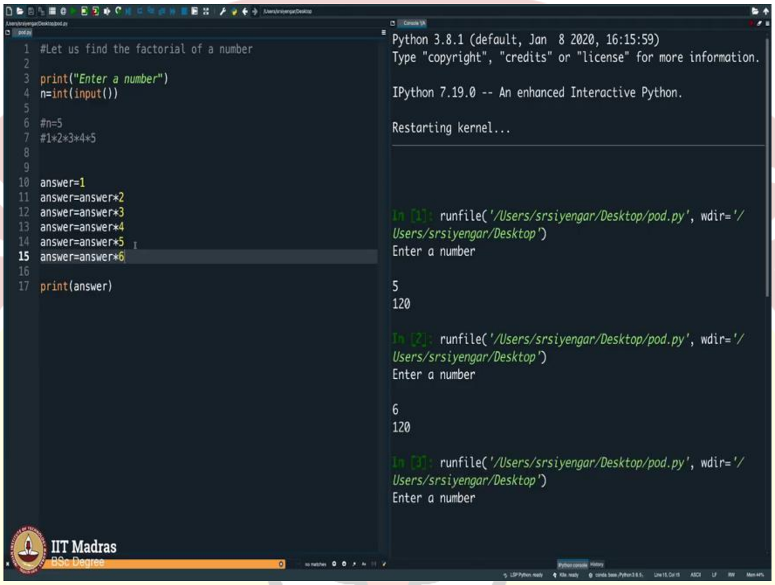
सिद्धिर्भवति कर्मजा

IIT Madras

ONLINE DEGREE

Programming in Python
Professor Sudarshan Iyengar
Department of Computer Science and Engineering
Indian Institute of Technology, Ropar
While to Compute Factorial

(Refer Slide Time: 00:16)



```python
#Let us find the factorial of a number

print("Enter a number")
n=int(input())

#n=5
#1*2*3*4*5


answer=1
answer=answer*2
answer=answer*3
answer=answer*4
answer=answer*5
answer=answer*6

print(answer)
```

```
Python 3.8.1 (default, Jan  8 2020, 16:15:59)
Type "copyright", "credits" or "license" for more information.

IPython 7.19.0 -- An enhanced Interactive Python.

Restarting kernel...




In [1]: runfile('/Users/srsiyengar/Desktop/pod.py', wdir='/
Users/srsiyengar/Desktop')
Enter a number

5
120

In [2]: runfile('/Users/srsiyengar/Desktop/pod.py', wdir='/
Users/srsiyengar/Desktop')
Enter a number

6
120

In [3]: runfile('/Users/srsiyengar/Desktop/pod.py', wdir='/
Users/srsiyengar/Desktop')
Enter a number
```

Let us try writing a code to find factorial of a number. We may do this particular code multiple times. In fact, there may be many a times where we will be repeating the same question in different ways. I mean, I will be using while loop to find factorial and then I may use some other way to find factorial and some yet another way to find factorial. Maybe the same question can be repeated three, four, five times. Do not find it repetitive rather we do that to ensure that you are, you know the question already but the way we solve it uses different techniques.

And we tend to teach you the syntax of Python by taking the same problem and teaching different syntax of Python. You will come to know, what I am saying with as the time progresses. So let us find the factorial of a number. This is going to be a very easy program. I in fact find it very boring. But for completeness sake I am teaching you people because every single programming book has this program and the standard question that people ask in exams and things like that.

So apart from making it interesting, I will also make attempts to try to make it boring here and there using standard examples. So how do you, how do you find the factorial of the number. I will first say print enter a number, then I will take the number let that number be int n, you know what this means. And then I will say the point is this, what is n factorial? When n equals 5, n factorial is 1 into 2 into 3 into 4 into 5. I should go up to that point. So how do I do that?

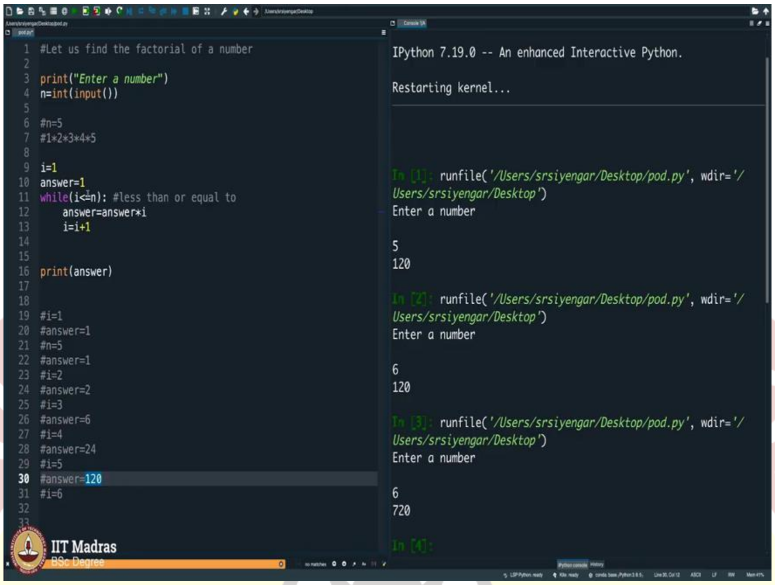
This is actually straightforward using a while loop. But first timers this is going to be one what a heck of a program you will not understand it in the first attempt. Although, I will make my, try my level best to help you understand it. But it requires two to three attempts of re-reading it, re-seeing, re-coding it for you to understand what is happening. So, what do we do here? I will say I will start with my answer to be 1 and I will multiply 2 to my answer.

Then this becomes answer is initially 1 and answer becomes answer into 2. And then answer equals answer into 3. And the answer equals answer into 4, answer equals answer into 5. What am I doing? Initially answer is 1 and answer equals answer into 2 means answer was 1 this becomes 1 into 2 and that becomes answer right now this becomes 2 answer equals answer into 3. So, which becomes, which makes it 2 into 3 which is 6 and then 6 times 4 which is 24, 24 times 5 which is 120.

At this stage answer will be 120. I am just using the compiler to as a blackboard. I am not supposed to write all these things like this. In fact, I can directly display the answer here. I can say print answer. It will of course ask for enter a number because 5 answer is 120. In fact, if you type 6 what will happen? type 6. So, I am trying to fool you all, it still says 120 it is not giving you the factorial of 6 because you are asking for a number n but you are simply manually computing the factorial of 5.

This is the way in which you compute the factorial of 5. If you want factorial of 6 then you must say answer equals answer times 6, then 6 and then 720. But the point is I should not be doing this manually every time. I want my computer to ask for a number, input a number and automatically it should show me the factorial of that number without me intervening and changing the code every time.

(Refer Slide Time: 04:44)



```
#Let us find the factorial of a number

print("Enter a number")
n=int(input())

#n=5
#1*2*3*4*5

i=1
answer=1
while(i<=n): #less than or equal to
    answer=answer*i
    i=i+1


print(answer)


#i=1
#answer=1
#n=5
#answer=1
#i=2
#answer=2
#i=3
#answer=6
#i=4
#answer=24
#i=5
#answer=120
#i=6
```

```
IPython 7.19.0 -- An enhanced Interactive Python.

Restarting kernel...



In [1]: runfile('/Users/srsiyengar/Desktop/pod.py', wdir='/
Users/srsiyengar/Desktop')
Enter a number

5
120

In [2]: runfile('/Users/srsiyengar/Desktop/pod.py', wdir='/
Users/srsiyengar/Desktop')
Enter a number

6
120

In [3]: runfile('/Users/srsiyengar/Desktop/pod.py', wdir='/
Users/srsiyengar/Desktop')
Enter a number

6
720

In [4]:
```

Now how do I do that? Watch carefully. What I do is I indeed start with answer equals 1 and I will put this entire thing inside a while loop. While i is less than or equal to n you will in a minute understand what this is. I will say answer equals answer times i which is i was initially 1 and answer is answer times 1. And then I will say i equals i plus 1, oh my God! What am I teaching you people?

If you are seeing this for the first time you are like programming is not for me, what are we doing here? So, it is all a matter of time, you will try to understand it a couple of times and you will understand it. So just wait for me to finish this, answer equals answer times I, I say i equals i plus 1 and then I come here. And then the while loop clears me provided i is less than or equal to n and answer becomes equals answer times 2 and then again answer times 3, the answer times 4 every time I gets incremented it comes here and then comes and then multiplies that to answer.

Now observe as in the previous example which was very easy. As long as this condition is true this will get executed once. Then if you come back check if the condition is true, it will get executed once more, check if the condition is true this will get executed once more and so on. Let me patiently try to understand what is happening here. Initially i is 1 and then answer is also 1. And then I check if i is less than or equal to n. Let us say n, I enter as 5, i which is 1 is certainly less than or equal to n which is 5, 1 is less than or equal to 5.

And hence it comes inside and it checks, it assigns answer equals answer times i which is answer will be 5 times 1. So, answer will now become I am sorry answer will is answer times i which is 1 times 1 answer will be 1. So, answer will be 1. And then again it come and i becomes 1 more which means i becomes 2 here in this line. And then it comes back and checks if i is less than or equal to n i is indeed less than or equal to n, is not it? Why?

i which is 2, n which is 5, 2 is less than or equal to 5 and it enters this loop. And then again it does answer equals answer a times I, so which is answer equals answer which was 1 times i, i used to be 1 but now it is 2, 1 times 2 then becomes 2. Then again comes back then checks if i is less or equal to n, 2 is less than or equal to 5 perfect it comes in once again and then says answer equals answer into I, answer is 2. i would have become 3 because i got incremented. So, your answer now will be 2 times 3 which is 6.

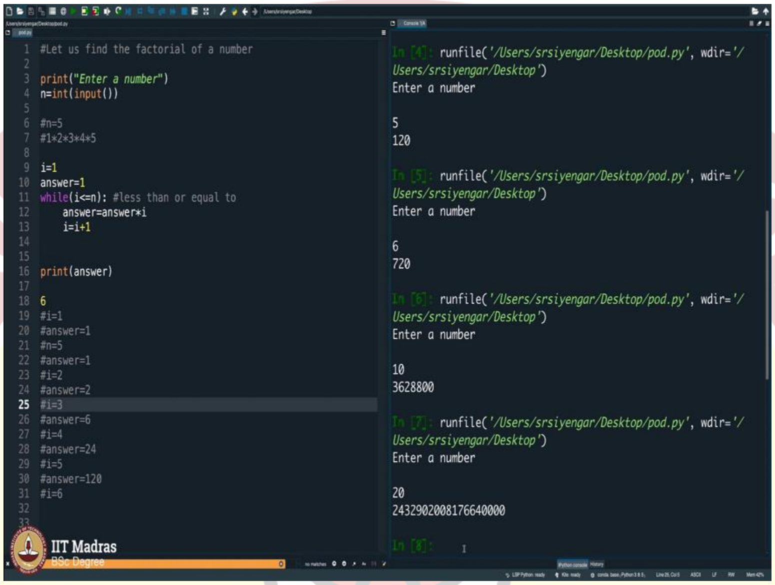
Similarly, again your i becomes 4 and then your answer becomes 6 times 4 which is 24. Again your i becomes 1 more i equals 5. And then it comes here 5 is less than or equal to n, n is what? n is 5, 5 is less than equal to 5, that is true. Is not it? 5 is indeed less than or equal to 5. So, what are you saying? 5 is equal to 5. Why do you say 5 is less than or equal to 5?

With that I mean 5 being less than or equal to 5 observe the word it says less than or equal to it should either be less than or it can be equal to, it cannot be greater, that is all it says. So, 5 less than or equal to 5 is indeed true. And it comes inside answer becomes answer times i which is answer equals 24 times 5 which is 120. And then i indeed gets 1 plus it becomes 6 and it comes right now and there you have a problem. What is the problem?

6 is less than or equal to 5, 6 is i, n is 5, 6 is less than or equal to 5 no that is not true. So, it exits this while, this does not execute what is it within while, it just jumps here and then comes here. And then prints the final answer, which is answer at that stage will be 120. Please note i keeps changing every time you change the value of i the previous value goes away, the recent value gets stored, n remains the same throughout, n equals 5, I do not change n, answer keeps changing.

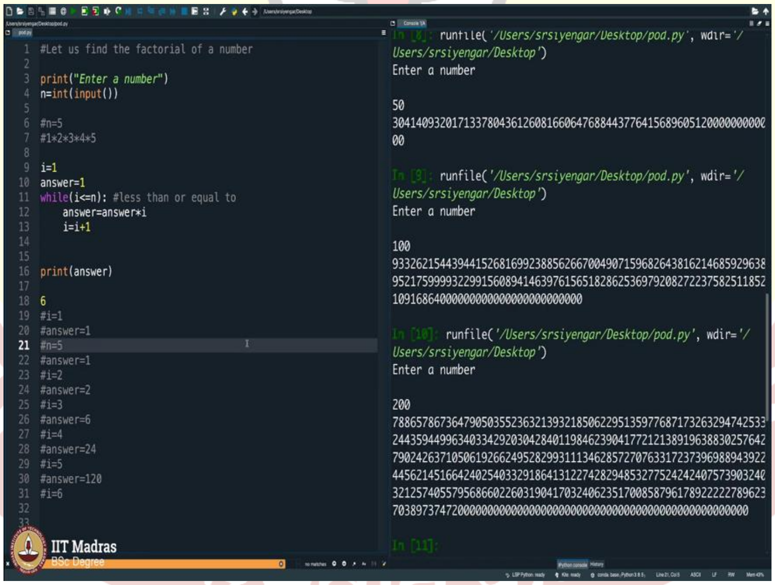
Now with this you are able to simulate the very process of finding factorial. You can simply say why do we do all these things in real life we simply put 1 into 2 into 3 into 4 into 5 and there we are, we get 120. But why does the computer do it this way. So, this is how you program with the flexibility of while, with the flexibility of using variables. This is one way in which you can find the factorial. So again, I repeat do not worry if you do not understand. In fact, all all that I did right now is very, very common sensical just that it takes some time for you to get this common sense. So now let us try executing this.

(Refer Slide Time: 10:33)



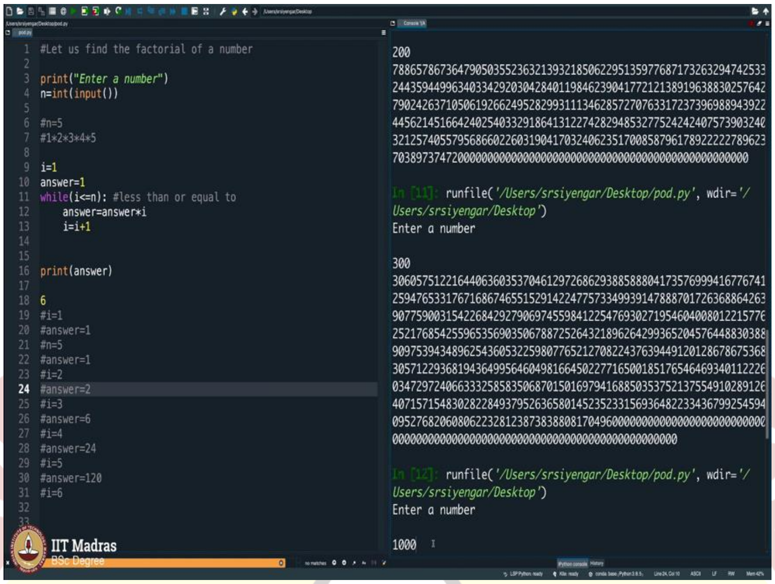
```
#Let us find the factorial of a number

print("Enter a number")
n=int(input())

#n=5
#1*2*3*4*5

i=1
answer=1
while(i<=n): #less than or equal to
    answer=answer*i
    i=i+1


print(answer)

6
#i=1
#answer=1
#n=5
#answer=1
#i=2
#answer=2
#i=3
#answer=6
#i=4
#answer=24
#i=5
#answer=120
#i=6
```

```
In [4]: runfile('/Users/srsiyengar/Desktop/pod.py', wdir='/
Users/srsiyengar/Desktop')
Enter a number

5
120

In [5]: runfile('/Users/srsiyengar/Desktop/pod.py', wdir='/
Users/srsiyengar/Desktop')
Enter a number

6
720

In [6]: runfile('/Users/srsiyengar/Desktop/pod.py', wdir='/
Users/srsiyengar/Desktop')
Enter a number

10
3628800

In [7]: runfile('/Users/srsiyengar/Desktop/pod.py', wdir='/
Users/srsiyengar/Desktop')
Enter a number

20
2432902008176640000

In [8]:
```



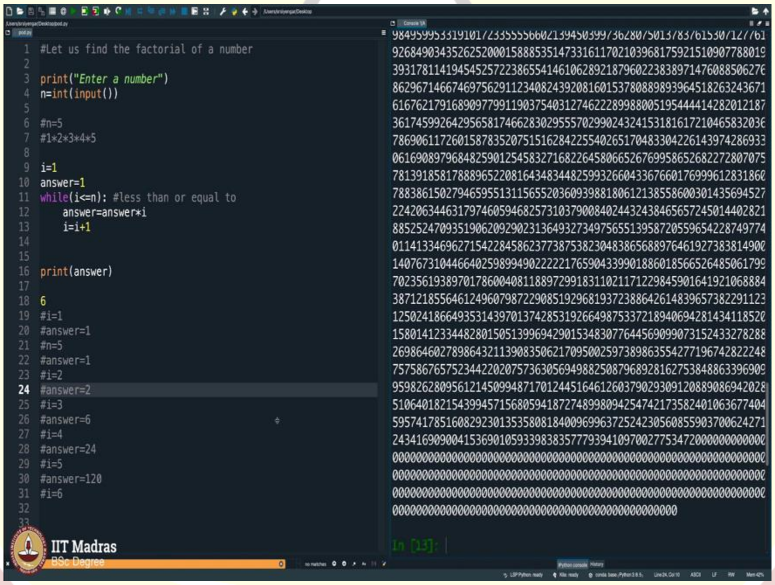
```
#Let us find the factorial of a number

print("Enter a number")
n=int(input())

#n=5
#1*2*3*4*5

i=1
answer=1
while(i<=n): #less than or equal to
    answer=answer*i
    i=i+1


print(answer)

6
#i=1
#answer=1
#n=5
#answer=1
#i=2
#answer=2
#i=3
#answer=6
#i=4
#answer=24
#i=5
#answer=120
#i=6
```

```
In [8]: runfile('/Users/srsiyengar/Desktop/pod.py', wdir='/
Users/srsiyengar/Desktop')
Enter a number

50
304140932017133780436126081660647688443776415689605120000000000
00

In [9]: runfile('/Users/srsiyengar/Desktop/pod.py', wdir='/
Users/srsiyengar/Desktop')
Enter a number

100
933262154439441526816992388562667004907159682643816214685929638
952175999932299156089414639761565182862536979208272237582511852
109168640000000000000000000000000

In [10]: runfile('/Users/srsiyengar/Desktop/pod.py', wdir='/
Users/srsiyengar/Desktop')
Enter a number

200
788657867364790503552363213932185062295135977687173263294742533
244359449963403342920304284011984623904177212138919638830257642
790242637105061926624952829931113462857270763317237396988943922
445621451664240254033291864131227428294853277524242407573903240
321257405579568660226031904170324062351700858796178922222789623
703897374720000000000000000000000000000000000000000000000000

In [11]:
```



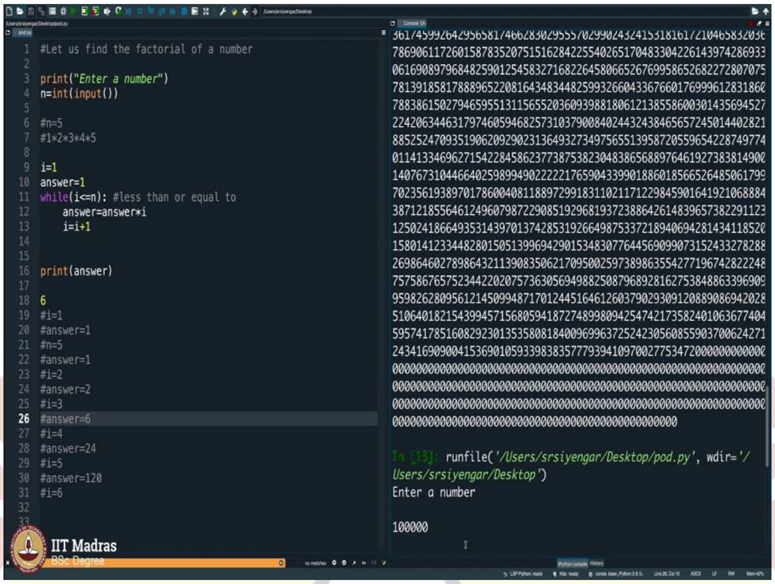
```python
#Let us find the factorial of a number

print("Enter a number")
n=int(input())

#n=5
#1*2*3*4*5

i=1
answer=1
while(i<=n): #less than or equal to
    answer=answer*i
    i=i+1


print(answer)

6
#i=1
#answer=1
#n=5
#answer=1
#i=2
#answer=2
#i=3
#answer=6
#i=4
#answer=24
#i=5
#answer=120
#i=6
```

```
200
788657867364790503552363213932185062295135977687173263294742533
244359449963403342920304284011984623904177212138919638830257642
790242637105061926624952829931113462857270763317237396988943922
445621451664240254033291864131227428294853277524242407573903240
321257405579568660226031904170324062351700858796178922222789623
7038973747200000000000000000000000000000000000000000000000000

In [11]: runfile('/Users/srsiyengar/Desktop/pod.py', wdir='/
Users/srsiyengar/Desktop')
Enter a number

300
306057512216440636035370461297268629388588804173576999416776741
259476533176716867465515291422477573349939147888701726368864263
907759003154226842927906974559841225476930271954604008012215776
252176854255965356903506788725264321896264299365204576448830388
909753943489625436053225980776521270822437639449120128678675368
305712293681943649956460498166450227716500185176546469340112226
034729724066333258583506870150169794168850353752137554910289126
407157154830282284937952636580145235233156936482233436799254594
095276820608062232812387383880817049600000000000000000000000000
000000000000000000000000000000000000000000000000

In [12]: runfile('/Users/srsiyengar/Desktop/pod.py', wdir='/
Users/srsiyengar/Desktop')
Enter a number

1000
```



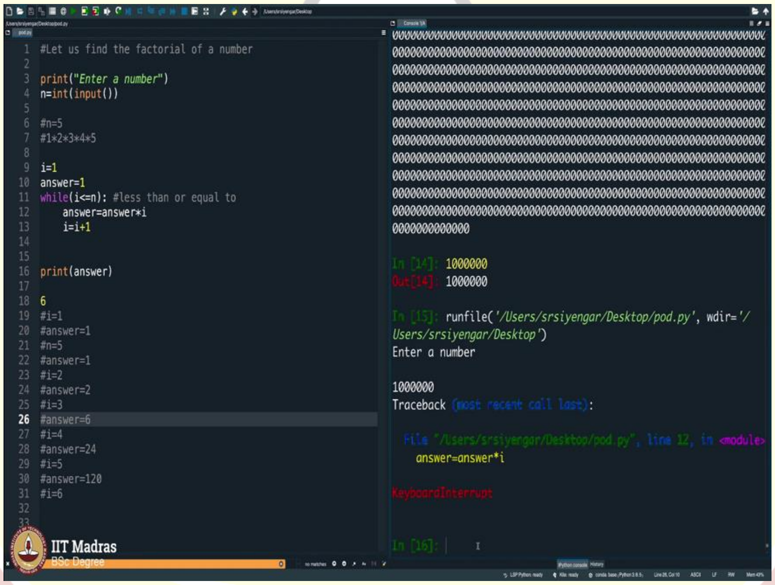
```python
#Let us find the factorial of a number

print("Enter a number")
n=int(input())

#n=5
#1*2*3*4*5

i=1
answer=1
while(i<=n): #less than or equal to
    answer=answer*i
    i=i+1


print(answer)

6
#i=1
#answer=1
#n=5
#answer=1
#i=2
#answer=2
#i=3
#answer=6
#i=4
#answer=24
#i=5
#answer=120
#i=6
```

```
984959953319101723355556602139450399736280750137837615307127761
926849034352625200015888535147331611702103968175921510907788019
393178114194545257223865541461062892187960223838971476088506276
862967146674697562911234082439208160153780889893964518263243671
616762179168909779911903754031274622289988005195444414282012187
361745992642956581746628302955570299024324153181617210465832036
786906117260158783520751516284225540265170483304226143974286933
061690897968482590125458327168226458066526769958652682272807075
781391858178889652208164348344825993266043367660176999612831860
788386150279465955131156552036093988180612138558600301435694527
224206344631797460594682573103790084024432438465657245014402821
885252470935190620929023136493273497565513958720559654228749774
011413346962715422845862377387538230483865688976461927383814900
140767310446640259899490222221765904339901886018566526485061799
702356193897017860040811889729918311021171229845901641921068884
387121855646124960798722908519296819372388642614839657382291123
125024186649353143970137428531926649875337218940694281434118520
158014123344828015051399694290153483077644569099073152433278288
269864602789864321139083506217095002597389863554277196742822248
757586765752344220207573630569498825087968928162753848863396909
959826280956121450994871701244516461260379029309120889086942028
510640182154399457156805941872748998094254742173582401063677404
595741785160829230135358081840096996372524230560855903700624271
243416909004153690105933983835777939410970027753472000000000000
000000000000000000000000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000000

In [13]:
```



```
#Let us find the factorial of a number

print("Enter a number")
n=int(input())

#n=5
#1*2*3*4*5

i=1
answer=1
while(i<=n): #less than or equal to
    answer=answer*i
    i=i+1


print(answer)

6
#i=1
#answer=1
#n=5
#answer=1
#i=2
#answer=2
#i=3
#answer=6
#i=4
#answer=24
#i=5
#answer=120
#i=6
```

```
361745992642956581746628302955570299024324153181617210465832036
786906117260158783520751516284225540265170483304226143974286933
061690897968482590125458327168226458066526769958652682272807075
781391858178889652208164348344825993266043367660176999612831860
788386150279465955131115655203609398818061213855860030143569452
224206344631797460594682573103790084024432438465657245014402821
885252470935190620929023136493273497565513958720559654228749774
011413346962715422845862377387538230483865688976461927383814900
140767310446640259899490222221765904339901886018566526485061799
702356193897017860040811889729918311021171229845901641921068884
387121855646124960798722908519296819372388642614839657382291123
125024186649353143970137428531926649875337218940694281434118520
158014123344828015051399694290153483077644569099073152433278288
269864602789864321139083506217095002597389863554277196742822248
757586765752344220207573630569498825087968928162753848863396909
959826280956121450994871701244516461260379029309120889086942028
510640182154399457156805941872748998094254742173582401063677404
595741785160829230135358081840096996372524230560855903700624271
243416909004153690105933983835777939410970027753472000000000000
000000000000000000000000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000000


In [13]: runfile('/Users/srsiyengar/Desktop/pod.py', wdir='/
Users/srsiyengar/Desktop')
Enter a number

100000
```



```
#Let us find the factorial of a number

print("Enter a number")
n=int(input())

#n=5
#1*2*3*4*5

i=1
answer=1
while(i<=n): #less than or equal to
    answer=answer*i
    i=i+1


print(answer)

6
#i=1
#answer=1
#n=5
#answer=1
#i=2
#answer=2
#i=3
#answer=6
#i=4
#answer=24
#i=5
#answer=120
#i=6
```

```
000000000000000000000000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000000000000000000000
0000000000000

In [14]: 1000000
Out[14]: 1000000

In [15]: runfile('/Users/srsiyengar/Desktop/pod.py', wdir='/
Users/srsiyengar/Desktop')
Enter a number

1000000
Traceback (most recent call last):

  File "/Users/srsiyengar/Desktop/pod.py", line 12, in <module>
    answer=answer*i

KeyboardInterrupt


In [16]:
```

For different values enter a number 5 is 120. Enter another number 6 should be how much? 1 into 2 into 3 into 4 into 5 into 6 up to 5 is 120, 6 factorial should be 6 into 120, 720 and there we are. And what is 10 factorial? It is a big number, you see. And what is 20 factorial? It is a very big number, 20 is a small number but 20 factorial is a very big number. You see things can get really big very fast. So factorial is one such function where things get really, really big, really fast.

For instance, I will try to type 50 factorial, oh it displays, I expected it not to display because it is a very big number. Let me try to type 100 it does display and 200, my computer is really fast and efficient. So, I would, I want to fool it, I want to try typing bigger and bigger numbers. 1000, 10000 maybe 100000. Now it is stuck. It is taking a long time. So, computers are great, computers are fast, computers are awesome. But as you increase the complexity there is a place where they will fail. Now it passed and I am sure if I type it for let us say a 1000000, it will take a few more minutes like what am I doing? I should say enter.

So, execute this code and then give 1000000, it will take ages, by ages I mean few minutes or maybe a few hours also. Okay fine. So, this is it, factorial of a number. I think you should practice this while I wait for this code to end. I probably should wait for a few hours now. Or I can always exit this by saying Ctrl C, you press Ctrl C it comes out of the programming. Let us go to the next code now.