Problem 5

2520 is the smallest number that can be divided by each of the numbers from 1 to 10 without any remainder.

What is the smallest positive number that is evenly divisible by all of the numbers from 1 to 20?

Solution

Using built-in functions:

In[78]:=
```
LCM @@ Range[20]
```

Out[78]=
```
232 792 560
```

Alternatively, by factorising:

In[83]:=
```
allFactors = Flatten[FactorInteger /@ Range[2, 20], 1]
```

Out[83]=
```
{{2, 1}, {3, 1}, {2, 2}, {5, 1}, {2, 1}, {3, 1}, {7, 1}, {2, 3},
 {3, 2}, {2, 1}, {5, 1}, {11, 1}, {2, 2}, {3, 1}, {13, 1}, {2, 1}, {7, 1},
 {3, 1}, {5, 1}, {2, 4}, {17, 1}, {2, 1}, {3, 2}, {19, 1}, {2, 2}, {5, 1}}
```

allFactors contains a list of {prime, power}, of which we need the maximum power for each prime. We gather them by which prime they represent; then for each prime, we take the maximum of the powers to which it is raised.

In[88]:=
```
Max /@ Map[Last, GatherBy[allFactors, First], {2}]
```

Out[88]=
```
{4, 2, 1, 1, 1, 1, 1, 1}
```

In[89]:=
```
Prime[Range[Length[%]]]^%
```

Out[89]=
```
{16, 9, 5, 7, 11, 13, 17, 19}
```

In[90]:=
```
Times @@ %
```

Out[90]=
```
232 792 560
```