Gears and Axles

How do you maximize the rate of spin? Mesh big gears with little ones. So, for every tooth size, sort them and match the biggest with the smallest, the next biggest with the next smallest, and so on.

Suppose you have 6 gears with the same size teeth. In sorted order, they are A, B, C, D, E, F.

The best rate of spin you can get is $\frac{A}{F} \times \frac{B}{E} \times \frac{C}{D}$.

If you take the natural log, that becomes $\ln A - \ln F + \ln B - \ln E + \ln C - \ln D$.

You start at 1hz. $\ln 1 = 0$. So, all you have to do is keep a running sum of the above for all the teeth, and the result is your answer.

Here is some Java code for you:

```java
ArrayList<Double> gears[] = new ArrayList[100000];
Arrays.fill( gears, null );

int n = sc.nextInt();
while( n-->0 )
{
  int s = sc.nextInt()-1;
  int c = sc.nextInt();
  if( gears[s]==null ) gears[s] = new ArrayList<Double>();
  gears[s].add( Math.log( c ) );
}

double angular = 0.0;
for(ArrayList<Double> gear : gears ) if( gear!=null )
{
  n = gear.size();
  Collections.sort( gear );
  for( int i=0; i<n/2; i++ )
  {
    angular += gear.get( n-i-1 ) - gear.get( i );
  }
}
ps.println( angular );
```