The title

Proof to the twin prime conjecture

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Abstract

The elementary proof to the twin prime conjecture.

The content of the article

Let p_s denote the s'th prime and P_s the product of the first s primes.

Define A_s to be the set of all positive integers less than P_s which are relatively prime to P_s.

1. Each A_s, for $s \geq 3$, contains two elements which differ by 2.

2. Consider the finite arithmetic progression $\{a + mP_s\}$, where a is in A_s and $0 \leq m < P_s$. There exist 2 arithmetic progressions where for the same m in each arithmetic progression there exist a prime number.

3. Combining 1) and 2), there is always a pair of twin primes which are relatively prime to P_s, and therefore infinitely many twin primes.

For every pair of values a, b in A_s differing by d, there exist at least $p_{s+1}-2$ pairs of values in A_{s+1} differing by d. (And exactly that many when d is not divisible by p_{s+1}).

Given this, the claim follows using induction with $d = 2$, noting for the base case that $11, 13$ are both in A_3.

The proof is as follows: Suppose a and b are in A_s, with $b-a = d$. Consider the set of values $a + mP_s$, where $0 \leq m < p_{s+1}$. These are all less than P_{s+1}, and since P_s is relatively prime to p_{s+1}, there is a unique value $m1$ with $a+m1P_s$ divisible by p_{s+1}. Similarly, there is a unique value $m2$ with $b+m2P_s$ divisible by p_{s+1}. Furthermore, if $m1 = m2$, then $(b+m2P_s)-(a+m1P_s) = d$ would be divisible by p_{s+1}. So when d is not divisable by p_{s+1}, for the $p_{s+1} - 2$ values of $0 \leq m < p_{s+1}$ which are not equal to $m1$ or $m2$, the pair $(a + mP_s, b + mP_s)$ are a pair in A_{s+1} differing by d.

Proof of 2

Consider the finite arithmetic progression $\{a + mP_s\}$, where a is in A_s and $0 \leq m < P_s$. There exist 2 arithmetic progressions where for the same m in each arithmetic progression there exist a prime number.

The largest number generate by $a + mP_s = {P_s}^2 - 1$ is when $a = P_s - 1$ and $m = P_s - 1$

Therefore all non-prime greater than 1 generated by arithmetic progression $a + mP_s$ must have an odd factor ≥ 3 and $\leq P_s - 1$

Consider the finite arithmetic progression $a+mP_s$, where $n \leq m < n+f$. If there exist a number divisable by f then there is a unique value $m1$ with $a + m1P_s$ divisible by f.

A method of counting numbers with factors ≥ 3 and $\leq P_s - 1$ in finite arithmetic progression $a + mP_s$ when $a \neq 1$ where all possible non-prime numbers are included.

Start with the largest factor being considered be $P_s - 1$ and only consider numbers generated by arithmetic progression $a + mP_s$ when $0 \leq m < P_s - 1$

Base case Assuming the first number generated by arithmetic progression $a1 + 0 \times P_s$ is divisable by $P_s - 1$. Leaving values generated by arithmetic progression when $1 \leq m < P_s - 1$ for $a1 + mP_s$ not divisable by $P_s - 1$. Induction Assume that the very next number generated by arithmetic progression is divisable by the smaller factor differing by 2. Assume that the second number generated by arithmetic progression $a1 + 1 \times P_s$ is divisable by $P_s - 1 - 2$ Leaving values generated by arithmetic progression when $1 + 1 \leq m < P_s - 1 - 1$ for $a1 + mP_s$ not divisable by $P_s - 1$ and not divisable by $P_s - 1 - 2$.

Assume that the very next number generated by arithmetic progression is divisable by the smaller factor differing by 2. Assume that the third number generated by arithmetic progression $a1 + 2 \times P_s$ is divisable by $P_s - 1 - 2 - 2$ Leaving values generated by arithmetic progression when $1 + 1 + 1 \leq m < P_s - 1 - 1 - 1$ for $a1 + mP_s$ not divisable by $P_s - 1$ and not divisable by $P_s - 1 - 2$ and not divisable by $P_s - 1 - 2 - 2$

Repeat until removing all factors less than or equal to $P_s - 1$ and greater than or equal to 3.

Able to find a numbers divisable by odd factors less than or equal to $P_s - 1$ and greater than or equal to 3 to numbers generated by arithmetic progression for $a1 + mP_s$ when $0 \leq m < \frac{P_s - 1}{2} + 1$. Unable to find a numbers divisable by odd factors less than or equal to $P_s - 1$ and greater than or equal to 3 to numbers generated by arithmetic progression for $a1 + mP_s$ when $\frac{P_s - 1}{2} + 1 \leq m < P_s$. More than half the elements generated by arithmetic progression are prime.

Lets assume that $a1 = 0$ then $a1 + mP_s = 0 + mP_s$ when $0 \leq m \leq P_s$. All non-prime numbers generated is a rectangle with one side equaling m and the other side equaling P_s. Keep the constraint all non-prime numbers > 1 must have an odd factor ≥ 3 and $\leq P_s$ and all non-prime numbers must only have odd factors and apply it to just the m side. . Keep the constraint all non-prime numbers are relatively prime to P_s and apply it to the P_s side where the idea is to keep the rectangle mP_s having the same area only able to divide P_s by a sth prime and multiple m by the same sth prime therefore impossible to grow the m side greater than P_s. Therefore to have more numbers divisable by an odd factor $o \geq 3$ and $o \leq P_s$ there must be $a1 + m1P_s$ and $a1 + m2P_s$ divisable by odd number o where $m1 \neq m2$ either $a1 + 1 \times P_s$ is divisable by o and $a1 + o \times P_s$ is divisable by o or $a1+$ even number $\times P_s$ is divisable by o and $al1 + o \times P_s$ is divisable by o. Both cases are nonsense.

Therefore there must exist a prime number in two different arithmetic progression where $a1 + m1P_s$, $a2 + m2P_s$, $a1 \neq a2$, $m1 = m2$

T is factor of

F is not factor of f

G is a gap

The example of representing factors of $7, 5, 3$ for an arithmetic progression

Example of when factor$= 7$

T,F,F,F,F,F,F

Example of when factor$= 5$

G,T,F,F,F,F,G

Example of when factor$= 3$

G,G,T,F,F,G,G

Reverse the order to represent factors of $7, 5, 3$ for the second arithmetic progression

F,F,F,F,F,F,T

G,F,F,F,F,T,G

G,G,F,F,T,G,G

It is not possible to generate a number in every column with an odd factor less then or equal to 7 and greater than or equal to 3.

Sieve 1 Arithmetic Progression Numerical Form

$$A_1 = \{1\}$$

$$m \times \prod_{i=1}^{1} p_i + 1 = 1, 3, 5, \ldots$$

Sieve 2 Arithmetic Progression Numerical Form

$$A_2 = \{1, 5\}$$

$$m \times \prod_{i=1}^{2} p_i + 1 = 1, 7, 13, 19, 25, \ldots$$

$$m \times \prod_{i=1}^{2} p_i + 5 = 5, 11, 17, 23, 29, \ldots$$

Sieve 3 Arithmetic Progression Numerical Form

$$A_3 = \{1, 7, 11, 13, 17, 19, 23, 29\}$$

$$m \times \prod_{i=1}^{3} p_i + 1 = 1, 31, 61, 91, 121, 151, 181, \ldots$$

$$m \times \prod_{i=1}^{3} p_i + 7 = 7, 37, 67, 97, 127, 157, 187, \ldots$$

$$m \times \prod_{i=1}^{3} p_i + 11 = 11, 41, 71, 101, 131, 161, 191, \ldots$$

$$m \times \prod_{i=1}^{3} p_i + 13 = 13, 43, 73, 103, 133, 163, 193, \ldots$$

$$m \times \prod_{i=1}^{3} p_i + 17 = 17, 47, 77, 107, 137, 167, 197, \ldots$$

https://www.reddit.com/r/badmathematics/comments/aljw4b
/elementary_proof_to_the_twin_prime_conjecture_to/

User Leet_Noob rewrote proof structure and proof to 1.