Logic Patterns in Prime Numbers

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1 Introduction

Define the meaning of, "prime numbers," without using zero as a notational aspect:

$$x|1$$

$$x|x$$

$$\forall y\, y < x$$
$$(y < x \wedge y|x) \exists z\, y = 1, x = zy$$
$$\forall y\, y < x$$
$$\neg(y < x \wedge y|x) \exists z\, y = z \vee x = zy$$

$$\exists y\, y < x$$
$$(y < x \wedge y|x) \exists z\, y = 1, x = zy$$
$$\exists y\, y < x$$
$$\neg(y < x \wedge y|x) \exists z\, y = z \vee x = zy$$

$$(y < x \wedge y|x) \wedge \neg(y < x \wedge y|x) y = 1, x = zy$$

Set Theory

https://en.wikipedia.org/wiki/Explicit$_{d}escriptionNegations_{a}nd_{q}uantifiers$

In mathematics, an explicit description of a set is a definition of a set. An explicit description is a description of a set that does not rely on the axiom of choice. For example, the set of all finite initial segments of the natural numbers is an explicit description of the natural numbers. The natural numbers can also be described by means of the von Neumann ordinal definition or the inductive definition, but these methods rely on the axiom of choice. "Explicit" is a mathematical term used to refer to an object that is specified without requiring further definition.

A set can be defined by an "explicit definition" or an "inductive definition". Explicitly described sets are those that are completely determined by the axioms of Zermelo–Fraenkel set theory and the axioms of boolean logic using first order logic or second order logic or perhaps third order logic. Explicitly specified sets may be defined by quantified Boolean formulae. Explicit definitions of sets do not involve the axiom of choice.

Explicit definitions are to be distinguished from axiomatic descriptions of sets such as the axiom of replacment, the axiom of pairing, the axiom of union and the axiom of infinity.

Let n be some ordered set.

$$(y < x \wedge y|x) \exists z \, y = z \vee x = zy$$

$$y < x \wedge y|xy = z \vee x = zy$$

$$\neg(y = z \vee x = zy) \wedge ygx \wedge y|x$$

$$(y < x \wedge \neg y|x) \vee (\neg y < x \vee \neg y|x)$$

$$\forall x \neg \left(\exists y \, y < x \wedge y|x \right)$$

$$(\neg y = z \vee \neg x = zy) \wedge \neg ygx \wedge \neg y|x$$

$$(y < x \wedge y|x) \exists z \, y = z \vee x = zy$$

$$(y < x \wedge y|x) \exists z \, y = z \vee x = zy$$

$$(yz \wedge y > z) \exists z \, y = z \vee x = zy$$

$$((\exists n \in N_2) \circ x) \cap ((\exists n \in N_1) \circ x)$$

x is a single set in some set of sets.

$$y < x \wedge y|xy = z \vee xi = zy$$

Note the, "xi."

$$\forall x \neg \left(\exists y \, y < x \wedge y|x \right)$$

$$(\forall x) \neg \left((\exists y \, y < x \wedge y|x) \right)$$

$$(\forall x)\left((\forall y)\ y \neq x \vee (\forall y) y > x \vee (\forall y) \neg (y|x)\right)$$

$$(\forall x)\left((\forall y)\ y \neq x \wedge (\forall y) y = x \wedge (\forall y)(y|x)\right)$$

$$(\forall x)\left((\forall y)\ y \neq x \wedge (\forall y) y > x \wedge (\forall y)(y|x)\right)$$

$$(\forall x)\left((\forall y)\ y \neq x \wedge (\forall y) y \neq x \wedge (\forall y)(y|x)\right)$$

$$(\forall x)\left((\forall y)\ y \neq x \wedge (\forall y)(y|x)\right)$$

$$(\forall x)\left((\forall y)\ y \neq x \wedge (\forall y)(x|y)\right)$$

$$(\forall x)\left((\forall y)\ y = 1 \wedge (x = y)\right)$$

$$\neg(y = z \vee xi = zy) \wedge \neg ygx \wedge \neg y|x$$

$$\neg(yz \vee xi = zy) \wedge \neg ygx \wedge \neg y|x$$

$$\neg(y = z \wedge \neg xi = zy) \wedge \neg ygx \wedge \neg y|x$$

$$\neg(y = z \wedge \neg(xi = zy)) \wedge \neg ygx \wedge \neg y|x$$

$$(x \not\subseteq y)(x \subseteq y)$$

Subset definition:

$$(y|x) \equiv y \subseteq x$$

$$\neg y \subseteq x \vee y \subseteq x$$

$$\neg(y \subseteq x \wedge \neg y \subseteq x)$$

$$y \subseteq x \vee \neg y \subseteq x$$

Consider a set of sets:

$$Y = \{y_1, y_2, ..., y_n\}$$

$$\forall y\ \ \neg(y \subseteq x \wedge \neg y \subseteq x) \vee \neg(y \subseteq x \wedge \neg y \subseteq x)$$

$$\forall y\ \ y_i \subseteq x \vee \neg y_i \subseteq x$$

$$(y_i \subseteq x \wedge \neg y_i \subseteq x) \vee (y_i \subseteq x \wedge \neg y_i \subseteq x)$$

$$(\forall y)\ (y_i \subseteq x \vee \neg y_i \subseteq x)$$

$$\neg\left(\forall y\ \ y_i \subseteq x \wedge \neg y_i \subseteq x\right)$$

$$\forall y_i \;\; y_i \subseteq x \vee \neg y_i \subseteq x$$

$$(\forall y_i) \;\; y_i \subseteq x \vee \neg y_i \subseteq x$$

$$\neg(y_i \subseteq x \wedge y_i \subseteq x)$$

$$y_i \subseteq x \vee \neg y_i \subseteq x$$

$$\neg \left(y_i \subseteq x \wedge y_i \subseteq x \wedge x_i \subseteq x \wedge \neg x_i \subseteq x\right)$$

$$\forall y_i \;\; \neg \left(y_i \subseteq x \wedge x_i \subseteq x\right)$$

$$\forall y_i \;\; \left(y_i \subseteq x \vee \neg y_i \subseteq x \wedge x_i \subseteq x \vee x_i \subseteq x\right)$$

$$(\forall y_i) \;\; \left((y_i \subseteq x \vee \neg y_i \subseteq x) \wedge (x_i \subseteq x \vee \neg x_i \subseteq x)\right)$$

$$(\forall y_i) \;\; y_i \subseteq x \vee \neg y_i \subseteq x \wedge y_i \subseteq x \vee \neg y_i \subseteq x$$

$$\triangle_y : \{y_i \subseteq x \vee \neg y_i \subseteq x\}$$

$$\exists \left(\bigwedge_{\forall y_i \in \triangle_y} y_i \subseteq x \right)$$

$$\forall y_i \;\; y_i \subseteq x \vee \neg y_i \subseteq x$$

For all elements in set, "x," belonging to some set of sets, all sets in set, "y," are contained or all membership is negated in set, "x."

$$(\forall y_i) \;\; y_i \subseteq x \vee \neg y_i \subseteq x$$

$$\triangle_Y = x$$

$$\forall x \;\; (\exists y_i \in Y) \;\; y_i \subseteq x \vee \neg y_i \subseteq x)$$

Simplify:
$\sum_{i=0}^{i \neq j} A_{ij} x_i = 0$
$A_{ij} \neq 0 \Rightarrow j = i$

$$\neg A_{ij} = 0 \Rightarrow \neg j = i$$

$$(A_{ij} \neq 0 \wedge \neg j = i) \vee (A_{ij} = 0 \wedge j = i)$$

Consider this statement:

$$\neg (\forall y_i \in Y) \;\; y_i \subseteq x \vee \neg y_i \subseteq x) \vee (\forall y_i \in Y) \;\; y_i \subseteq x \vee \neg y_i \subseteq x)$$

$$\forall y_i \in Y) \;\; (\neg (y_i \subseteq x \vee \neg y_i \subseteq x) \vee (y_i \subseteq x \vee \neg y_i \subseteq x))$$

$$\forall y_i \in Y) \;\; ((y_i \subseteq x \wedge \neg\neg y_i \subseteq x) \vee (y_i \subseteq x \vee \neg y_i \subseteq x))$$

$$\forall y_i \in Y) \;\; ((y_i \subseteq x \wedge y_i \subseteq x) \vee (y_i \subseteq x \vee \neg y_i \subseteq x))$$

$$\forall y_i \in Y) \;\; (y_i \subseteq x \vee (y_i \subseteq x \vee \neg y_i \subseteq x))$$

$$\forall y_i \in Y) \;\; y_i \subseteq x \vee (y_i \subseteq x \vee \neg y_i \subseteq x)$$

$$\forall y_i \in Y) \;\; y_i \subseteq x \vee$$

$$\forall y_i \in Y) \;\; y_i \subseteq x$$

$$\forall y_i \in Y) \;\; y_i \subseteq x$$

Let, "x," be a single set of some set of sets:

$$\exists \left(\bigwedge_{\forall y_i \in \triangle_y} y_i \subseteq x \right)$$

$$\exists \left(\bigwedge_{\forall y_i \in Y} y_i \subseteq x \right)$$

$$\exists \left(\bigwedge_{\forall y_i \in \triangle_y} \right) y_i \subseteq x$$

$$\exists \left(\bigwedge_{\forall y_i \in Y} \right) y_i \subseteq x$$

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$$\exists \left(\bigwedge_{\forall y_i \in Y} \right) y_i \subseteq x$$

$$(\forall y_i \in \triangle_y)\,(\exists y_i \subseteq x)$$

$$(\forall y_i \in Y)\,(\exists y_i \subseteq x)$$

$$(\forall y_i \in \triangle_y)\,(\exists y_i \subseteq x)$$

$$(\forall y_i \in Y)\,(\exists y_i \subseteq x)$$

$$\forall \left(\bigwedge_{\forall y_i \in Y} y_i \right) (\exists y_i \in Y)\,(\exists \forall y_i \in \triangle_x y_i)$$

$$\exists \left(\bigvee_{\forall y_i \in Y} y_i \in Y \right) \left(\bigvee_{\forall y_i \in \triangle_x} y_i \in \triangle_x \right)$$

$$\exists \left(\bigwedge_{\forall y_i \in Y} y_i \in Y \right) \left(\bigwedge_{\forall y_i \in \triangle_x} y_i \in \triangle_x \right)$$

$$\exists \left(\bigwedge_{\forall y_i \in Y} \right) \exists y_i \in Y \exists \left(\bigwedge_{\forall y_i \in \triangle_x} \right) y_i \in \triangle_x$$

$$(\forall y_i \in Y) \left(\exists \bigwedge_{\forall y_i \in Y} \right) y_i \in Y \left(\exists \bigwedge_{\forall y_i \in \triangle_x} \right) y_i \in \triangle_x$$

$$\exists\,(\forall y_i \in \triangle_y)\, y_i \subseteq x$$

$$\exists\,(\forall y_i \in X)\, y_i \subseteq x$$

$$\exists\,(y_i \in X)\, y_i \subseteq x$$

$$\exists\,(\forall y_i \in X)\,(\forall x \in X)\,y_i \subseteq x$$

$$\exists\,(y_i \in X)\,(\exists x \in X)\,y_i \subseteq x$$

$$\exists\,(y_i \in X)\,(x \in X)\,y_i \subseteq x$$

$$\exists\,(y_i \in X)\,(x \in X)\,(y_i \subseteq x)$$

$$\exists\,(\forall y_i \in X)\,(x \in X)\,y_i \subseteq x$$

$$\exists\,(\forall y_i \in X)\,(\exists x \in X)\,y_i \subseteq x$$

$$\exists\,(\forall y_i \in X)\,(y_i \subseteq x)$$

$$\exists\,(\forall y_i \in X)\,y_i \subseteq \bigvee x$$

$$\forall x \quad \Big(\bigwedge (\forall y_i \in Y_x)\Big)\,y_i \subseteq x$$

$$(\forall x \quad \bigwedge (\forall y_i \in Y_x)\,y_i \subseteq x)$$

$$(\forall x \;\; \exists\,(\forall y_i \in Y_x)\,y_i \subseteq x)$$

$$(\forall x \;\; \exists\,(\forall y_i \in Y_x)\,(x \in Y_x)\,y_i \subseteq x)$$

$$(\forall x \in Y_x \;\; \exists\,(\forall y_i \in Y_x)\,(x \in Y_x)\,y_i \subseteq x)$$

$$(\forall x \in Y_x \;\; \exists\,(\forall x \in Y_x)\,(x \in X)\,x \subseteq x)$$

$$(\forall x \in X \;\; \exists\,(\forall x \in X)\,(x \in X)\,x \subseteq x)$$

$$(\forall x \in X \;\; \exists\,(\forall x \in X)\,(x \in X)\,x \subseteq x)$$

$$(\forall x \in X \;\; \exists\,(\forall x \in \triangle_x)\,(x \in \triangle_x)\,\Big(\bigvee x \in \triangle_x\Big)\,x \subseteq x)$$

$$(\forall x \in X \;\; \exists\,(\forall x \in X)\,(x \in X)\,x \subseteq x)$$

$$(\exists\forall x \in X)\,(\exists\forall x \in X)\,(\exists\forall x \in X)\,(\exists x \in X)\,x \subseteq x$$

$$\Big(\forall x \in \triangle_x\ \exists \bigvee x \in \triangle_x\Big)\,x \subseteq x$$

$$\Big(\forall x \in \triangle_x\ \exists \bigvee x \in \triangle_x\Big)\,x \subseteq x$$

$$(\forall x \in \triangle_x\ x \in \triangle_x \vee \bigvee x \in \triangle_x)$$

$$(\forall x\ x \in X \vee \bigvee x \in X)$$

$$(\forall x\ x \in \triangle_x \vee \bigvee x \in \triangle_x)$$

$$\exists Y : (\forall x \in Y\ x \in Y)$$

$$\exists\,(\forall x \in X)\,(x \in X)\,x \subseteq x$$

$$\exists\,(\forall x \in X)\,x \subseteq x$$

$p \in N \setminus 1, n \in Z : n|p \to n \in p, 1.$ then, $\forall f_1, f_2 \in R : \exists x \in R : such : that : f_1(x) = f_2(x) \wedge f_1(x) = p \in N \setminus 1, n \in Z : n|p \to n \in p, 1$

Given a logic space:

$$\frac{f_P(x) - f_R(x)}{\Delta} \to \frac{f_T(x) - f_R(x)}{\Delta} \wedge \frac{f_P(x) - f_T(x)}{\Delta}$$

$$\frac{f_P(x) - f_R(x)}{\Delta} \to \frac{d_P(x) - d_R(x)}{\Delta} \wedge \frac{d_P(x) - d_T(x)}{\Delta}$$

$$\frac{d_P(x) - d_R(x)}{\Delta} \to \frac{d_T(x) - d_R(x)}{\Delta} \wedge \frac{d_P(x) - d_T(x)}{\Delta}$$

$$\frac{d_P(x) - d_T(x)}{\Delta} \to \frac{d_R(x) - d_T(x)}{\Delta} \wedge \frac{d_P(x) - d_R(x)}{\Delta}$$

$$\frac{d_P(x) - d_T(x)}{\Delta} \to \frac{d_R(x) - d_T(x)}{\Delta} \wedge \frac{d_P(x) - d_R(x)}{\Delta}$$

$$\frac{d_P(x) - d_T(x)}{\Delta} \to \frac{d_T(x) - d_R(x)}{\Delta} \wedge \frac{d_P(x) - d_R(x)}{\Delta}$$

$$\frac{d_P(x) - d_T(x)}{\Delta} = \frac{f_P(x) - f_R(x)}{\Delta} \wedge \frac{d_P(x) - d_R(x)}{\Delta}$$

$$\frac{d_P(x) - d_T(x)}{\Delta} = \frac{f_P(x) - f_R(x)}{\Delta} \cup \frac{d_P(x) - d_R(x)}{\Delta}$$

$$\frac{d_P(x) - d_T(x)}{\Delta} \leq \frac{d_P(x) - d_R(x)}{\Delta} \wedge \frac{f_P(x) - f_R(x)}{\Delta}$$

$$\frac{d_P(x) - d_T(x)}{\Delta} \leq \frac{d_P(x) - d_R(x)}{\Delta} \vee \frac{f_P(x) - f_R(x)}{\Delta}$$

$$\frac{d_P(x) - d_T(x)}{\Delta} \leq \frac{d_P(x) - d_R(x)}{\Delta} \vee \frac{f_P(x) - f_R(x)}{\Delta}$$

$$\frac{d_P(x) - d_T(x)}{\Delta} \leq \frac{d_P(x) - d_R(x)}{\Delta} \vee \frac{f_P(x) - f_R(x)}{\Delta}$$

$$\frac{\frac{d_P(x) - d_T(x)}{\Delta}}{\frac{d_P(x) - d_R(x)}{\Delta}} \leq \frac{d_P(x) - d_R(x)}{\Delta} \vee \frac{d_P(x) - d_R(x)}{\Delta}$$

$$\frac{\frac{d_P(x) - d_T(x)}{\Delta} \wedge \frac{d_P(x) - d_T(x)}{\Delta}}{\frac{d_P(x) - d_R(x)}{\Delta}} \leq \frac{d_P(x) - d_R(x)}{\Delta}$$

$$\frac{\frac{d_P(x) - d_T(x)}{\Delta} \wedge \frac{f_P(x) - f_T(x)}{\Delta}}{\frac{d_P(x) - d_R(x)}{\Delta}} \leq \frac{d_P(x) - d_R(x)}{\Delta}$$

$$\frac{(d_P(x) - d_T(x))^2}{\Delta^2} + \frac{(d_P(x) - f_T(x))^2}{\Delta^2}$$

$$\frac{(d_P(x) - d_T(x))^2}{\Delta^2} + \frac{(f_P(x) - f_T(x))^2}{\Delta^2}$$

$$\frac{\delta_x^2}{\Delta^2} + \frac{\delta_f^2}{\Delta^2}$$

$$\frac{d(x) - d(x + \Delta)}{\Delta} \geq 1$$

$$\frac{f(x) - f(x+\Delta)}{\Delta} \geq 1$$

$$\frac{d(x+2\Delta) - d(x+\Delta)}{\Delta} \geq 1$$

$$\frac{f(x+2\Delta) - f(x+\Delta)}{\Delta} \geq 1$$

$$\frac{d(x) - d(x+\Delta)}{\Delta} \leq 1$$

$$\frac{f(x) - f(x+\Delta)}{\Delta} \leq 1$$

$$\frac{d(x+2\Delta) - d(x+\Delta)}{\Delta} \leq 1$$

$$\frac{f(x+2\Delta) - f(x+\Delta)}{\Delta} \leq 1$$

$$\forall x d(x) < d(x+\Delta) \frac{d(x) - d(x+\Delta)}{\Delta} \geq -1$$

$$\forall x d(x) > d(x+\Delta) \frac{d(x) - d(x+\Delta)}{\Delta} \leq -1$$

$$\forall x d(x) < d(x+\Delta) 0 \leq \frac{d(x) - d(x+\Delta)}{\Delta}$$

$$\forall x d(x) \geq d(x+\Delta) \frac{d(x) - d(x+\Delta)}{\Delta} \leq 0$$

$$\forall x d(x) \geq d(x+\Delta) 0 \geq \frac{d(x) - d(x+\Delta)}{\Delta}$$

$$\frac{d(x) - d(x+\Delta)}{\Delta} \leq \epsilon \forall x d(x) \geq d(x+\Delta) - \epsilon$$

$$\frac{d(x) - d(x+\Delta)}{\Delta} \geq -\epsilon \forall x d(x) \geq d(x+\Delta) + \epsilon$$

$$-1 \leq \frac{d(x) - d(x+\Delta)}{\Delta} \leq \epsilon \forall x d(x) \geq d(x+\Delta) - \epsilon$$

$$||||$$

$$\frac{f(x) - f(x+\Delta)}{\Delta} \leq \frac{\delta\Delta}{\sigma} \forall x f(x) \geq f(x+\Delta) - \frac{\delta\Delta^2}{\sigma}$$

$$\frac{f(x) - f(x+\Delta)}{\Delta} \geq -\frac{\delta\Delta}{\sigma} \forall x f(x) \geq f(x+\Delta) + \frac{\delta\Delta^2}{\sigma}$$

$$\frac{1}{2}\frac{d(x) - d(x+\Delta)}{\Delta} \leq \frac{1}{2}\epsilon \forall x d(x) \geq d(x+\Delta) + \Delta\epsilon$$

$$-\frac{1}{2}\frac{d(x) - d(x+\Delta)}{\Delta} \leq \frac{1}{2}\epsilon \forall x d(x) \geq d(x+\Delta) - \Delta\epsilon$$

$$-1 \leq \frac{d(x) - d(x+\Delta)}{\Delta} \leq \epsilon$$