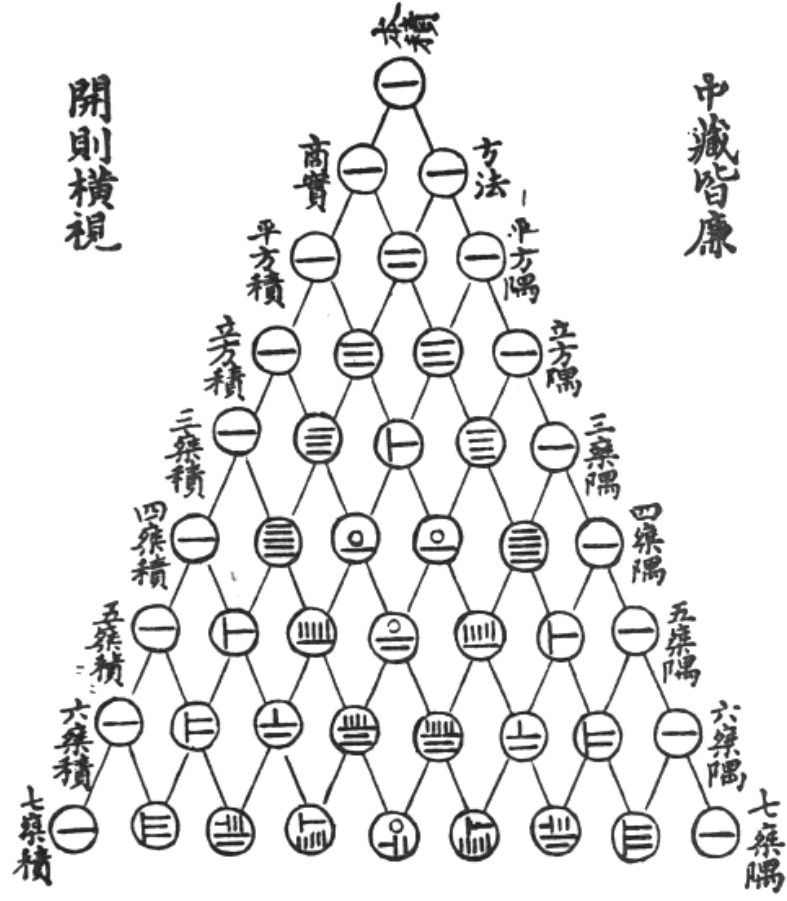


1-Patterns  
True vs. Accidental

2-Patterns  
In Media Content

Nello Cristianini

# 古法七乘方圖



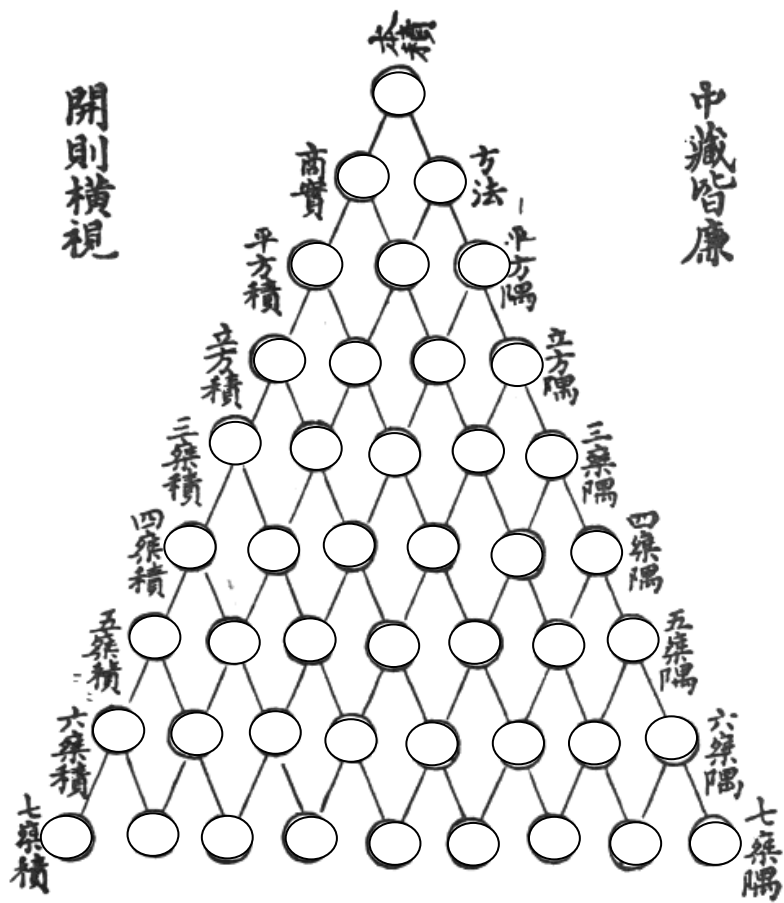
開則橫視

中藏皆廉

七乘積	六乘積	五乘積	四乘積	三乘積	二乘積	一乘積	方法	本積
-----	-----	-----	-----	-----	-----	-----	----	----



# 古法七乘方圖

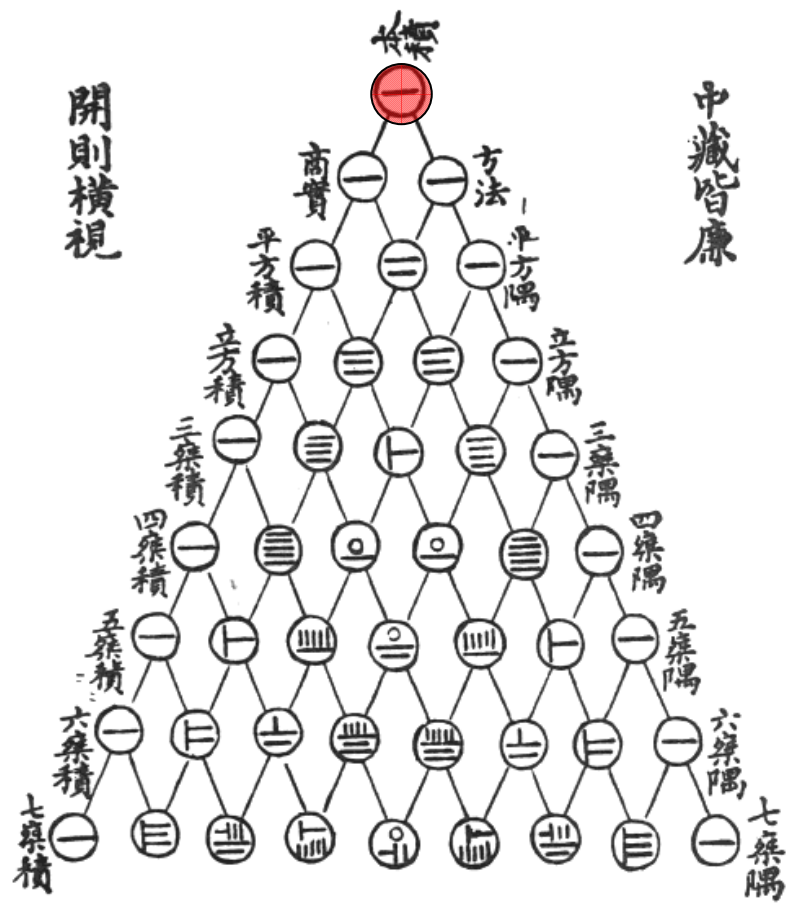


開則橫視

中藏皆廉

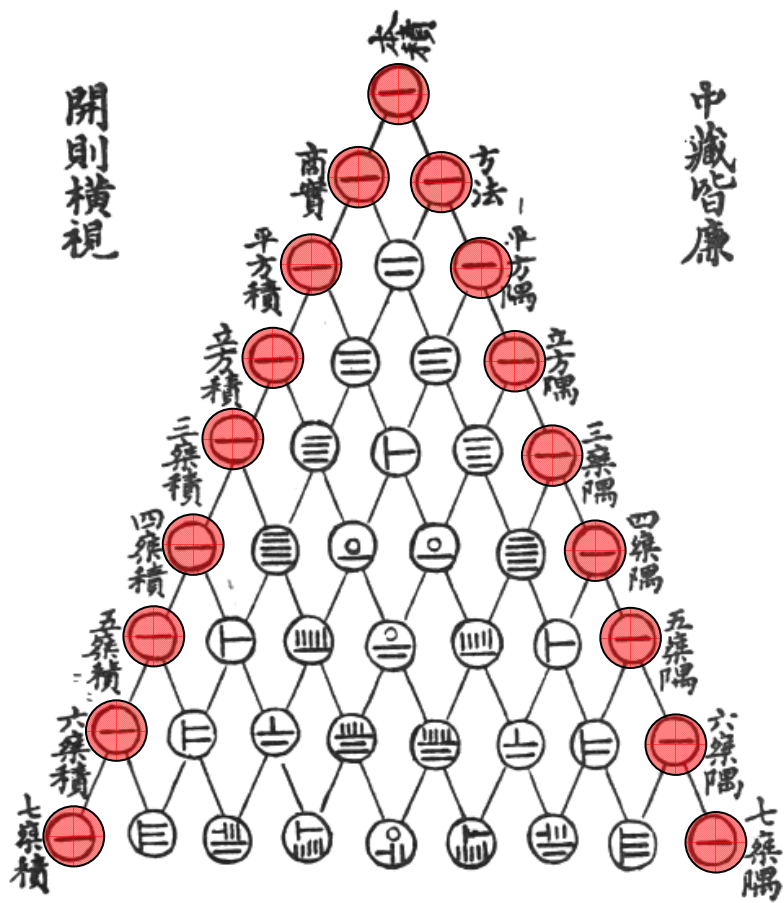
本積	方法	上廉	二廉	三廉	四廉	五廉	六廉	七廉
----	----	----	----	----	----	----	----	----

# 古法七乘方圖



本積	方法	上廉	二廉	三廉	四廉	五廉	六廉	七廉
----	----	----	----	----	----	----	----	----

# 古法七乘方圖



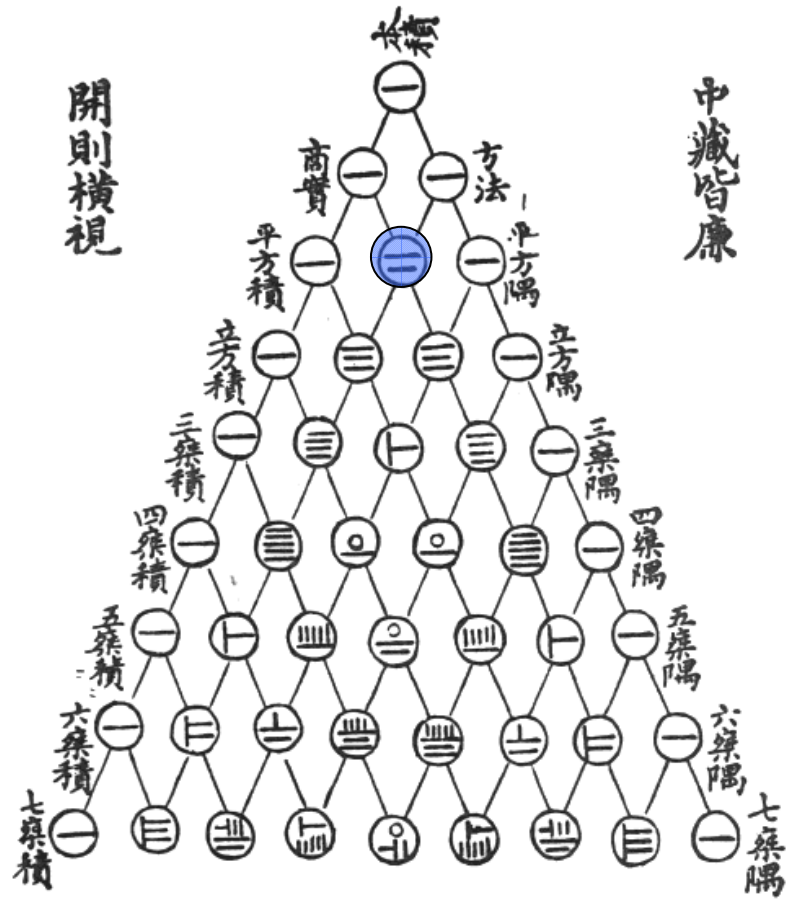
開則橫視

中藏皆廉

本積	方法	上廉	二廉	三廉	四廉	五廉	六廉	七廉
----	----	----	----	----	----	----	----	----

- ①
- ②
- ③
- ④
- ⑤
- ⑥
- ⑦
- ⑧
- ⑨
- ⑩
- ⑪
- ⑫
- ⑬
- ⑭
- ⑮
- ⑯
- ⑰
- ⑱
- ⑳

# 古法七乘方圖



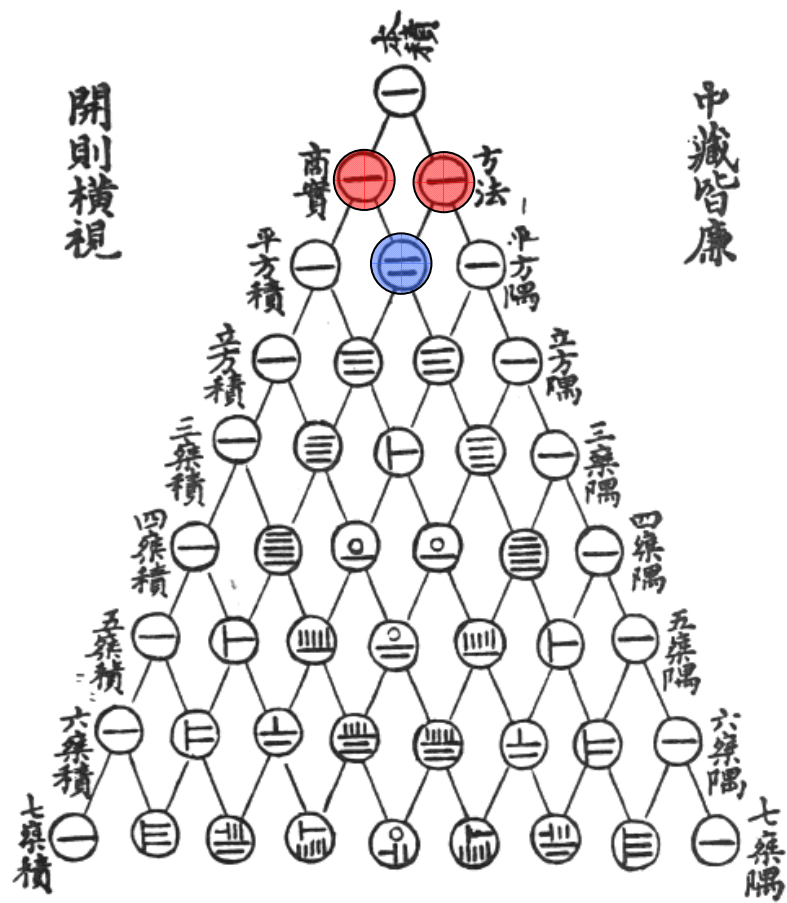
開則橫視

中藏皆廉

本積	方法	上廉	二廉	三廉	四廉	五廉	六廉	七廉
----	----	----	----	----	----	----	----	----

- ①
- ②
- ③
- ④
- ⑤
- ⑥
- ⑦
- ⑧
- ⑨
- ⑩
- ⑪
- ⑫
- ⑬
- ⑭
- ⑮
- ⑯
- ⑰
- ⑱
- ⑳

# 古法七乘方圖



開則橫視

中藏皆廉

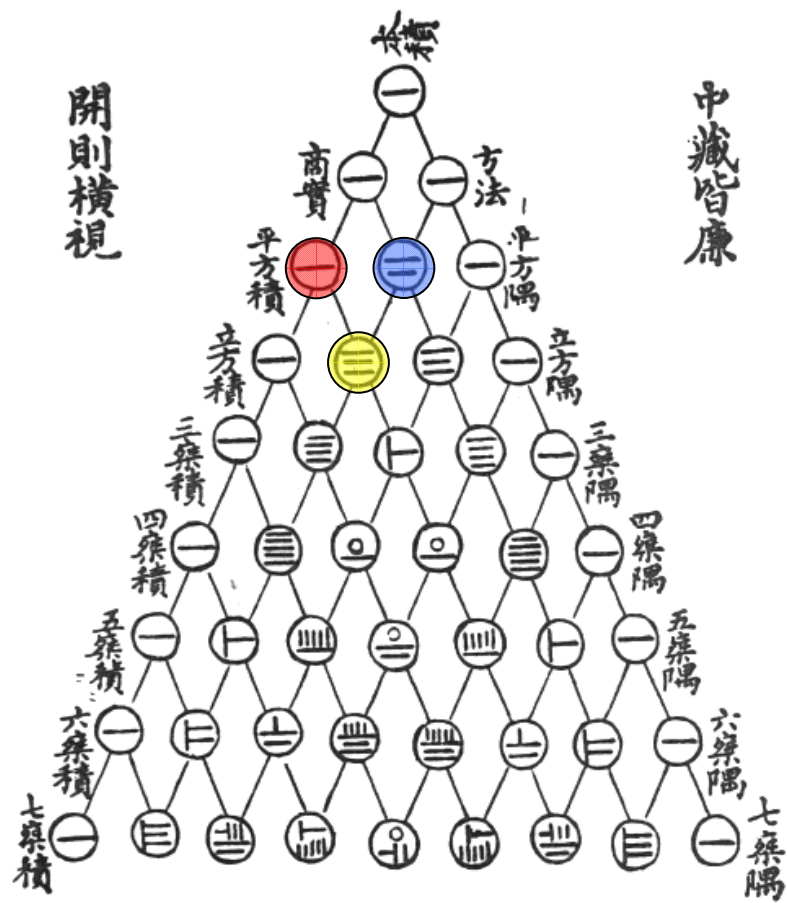
七乘積	六乘積	五乘積	四乘積	三乘積	二乘積	一乘積	方法	七乘隅
-----	-----	-----	-----	-----	-----	-----	----	-----



1  
2



# 古法七乘方圖



開則橫視

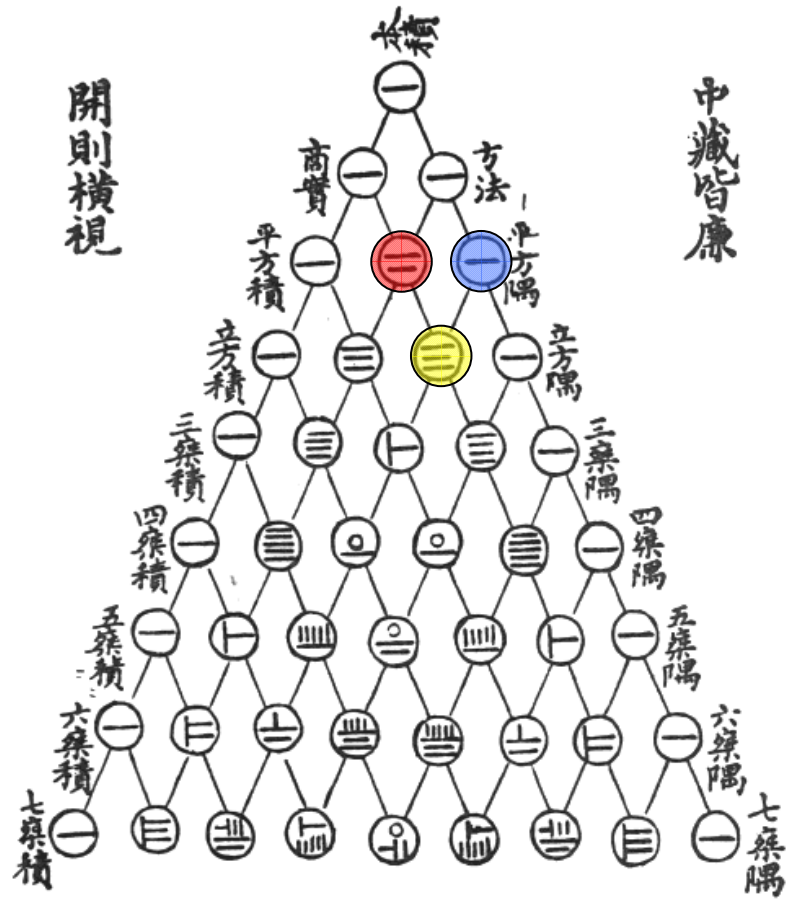
中藏皆廉

本積	方法	一廉	二廉	三廉	四廉	五廉	六廉	七廉
----	----	----	----	----	----	----	----	----



1  
2

# 古法七乘方圖



開則橫視

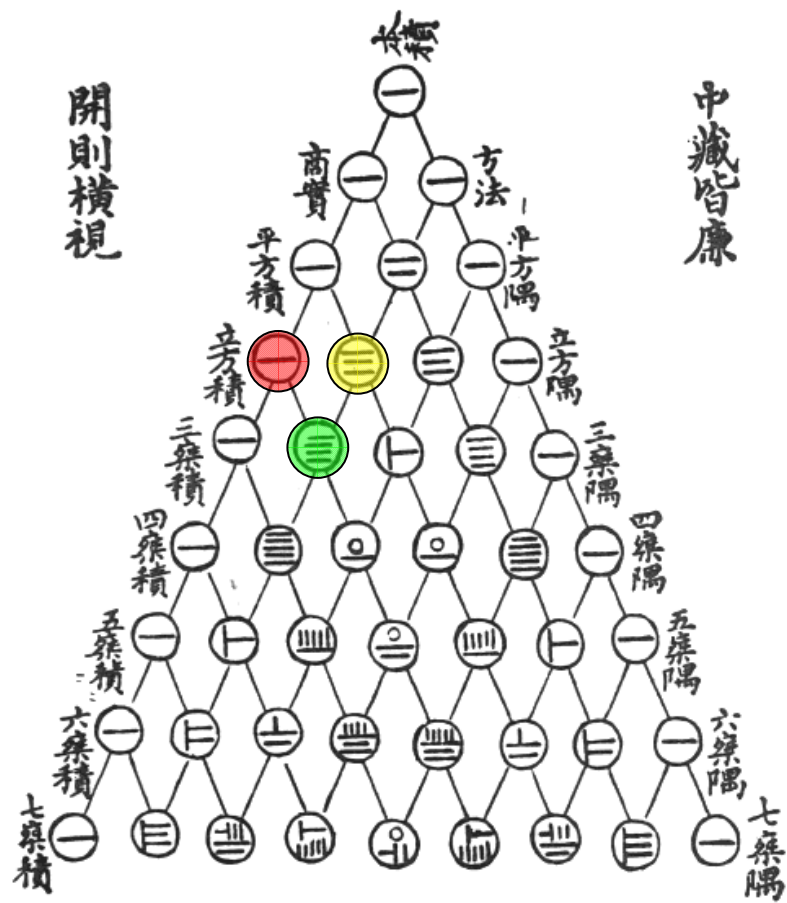
中藏皆廉

本積	方法	上廉	二廉	三廉	四廉	五廉	六廉	七廉
----	----	----	----	----	----	----	----	----

- ①
- ③
- ⑤
- ⑦
- ⑨
- ⑪
- ⑬
- ⑮
- ⑰
- ⑱
- ⑲
- ⑳
- ㉑
- ㉓
- ㉕
- ㉗
- ㉙
- ㉛
- ㉝
- ㉟
- ㊱
- ㊳
- ㊵
- ㊷
- ㊹
- ㊻
- ㊽
- ㊿

1  
2  
3

# 古法七乘方圖



開則橫視

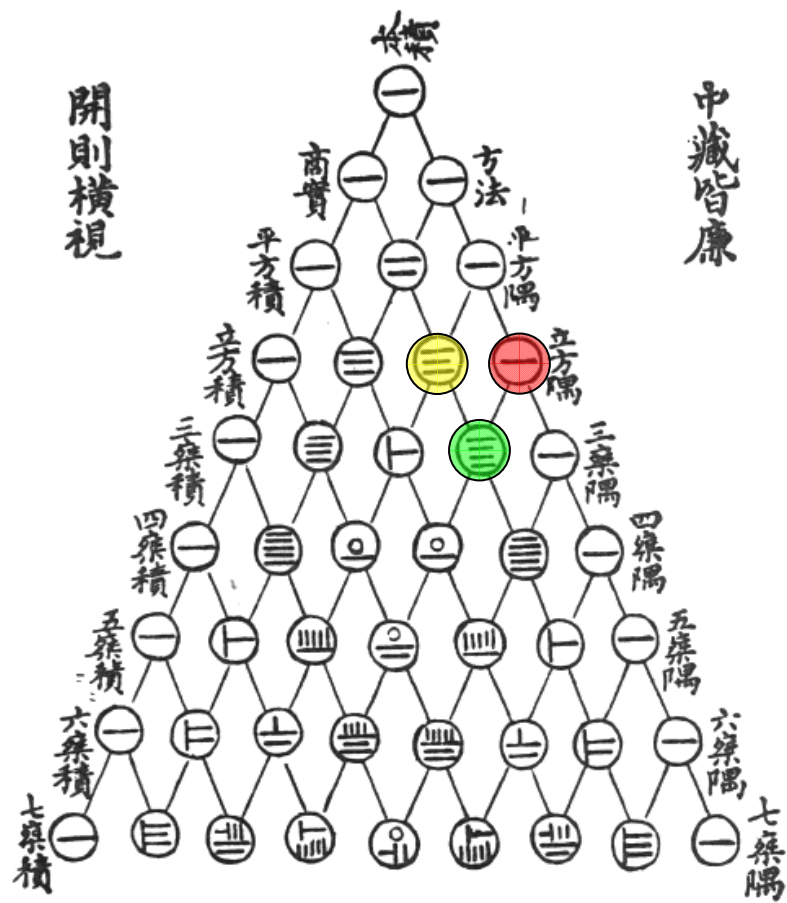
中藏皆廉

七乘積	六乘積	五乘積	四乘積	三乘積	二乘積	一乘積	方法	七乘
-----	-----	-----	-----	-----	-----	-----	----	----



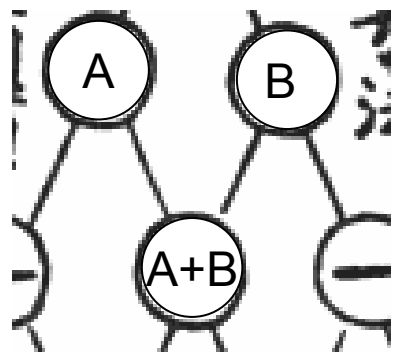
1  
2  
3

# 古法七乘方圖

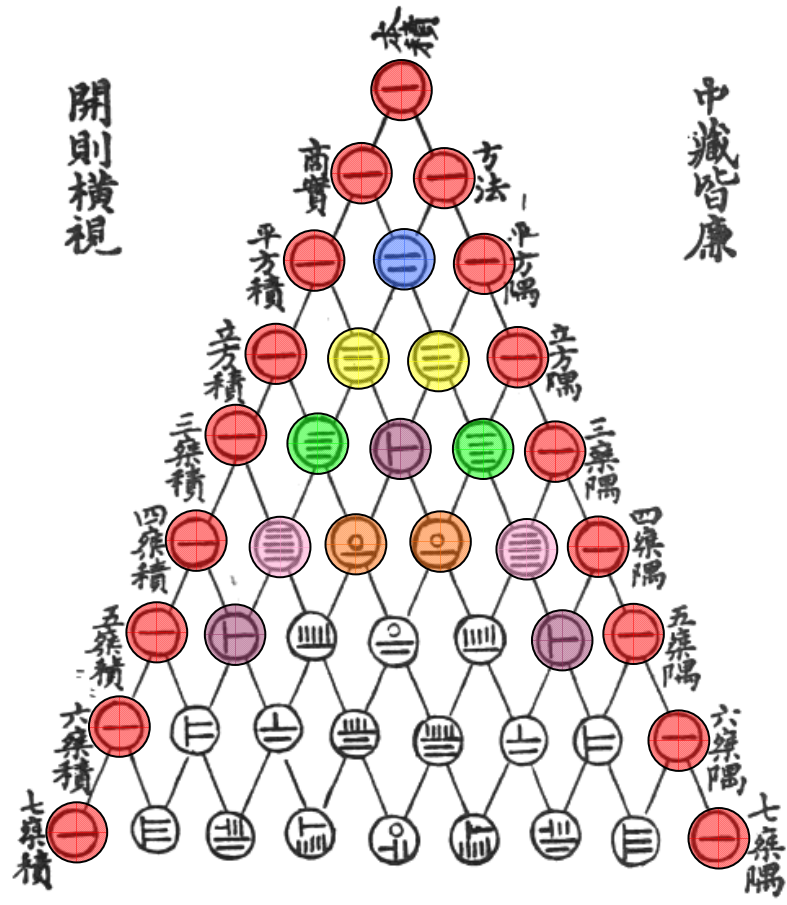


本積	方法	上廉	二廉	三廉	四廉	五廉	六廉	七廉
----	----	----	----	----	----	----	----	----

- 1 ☰
- 2 ☷
- 3 ☳
- 4 ☴
- 5 ☱
- 6 ☵
- 7 ☶
- 8 ☲
- 9 ☸
- 10 ☱
- 11 ☵
- 12 ☶



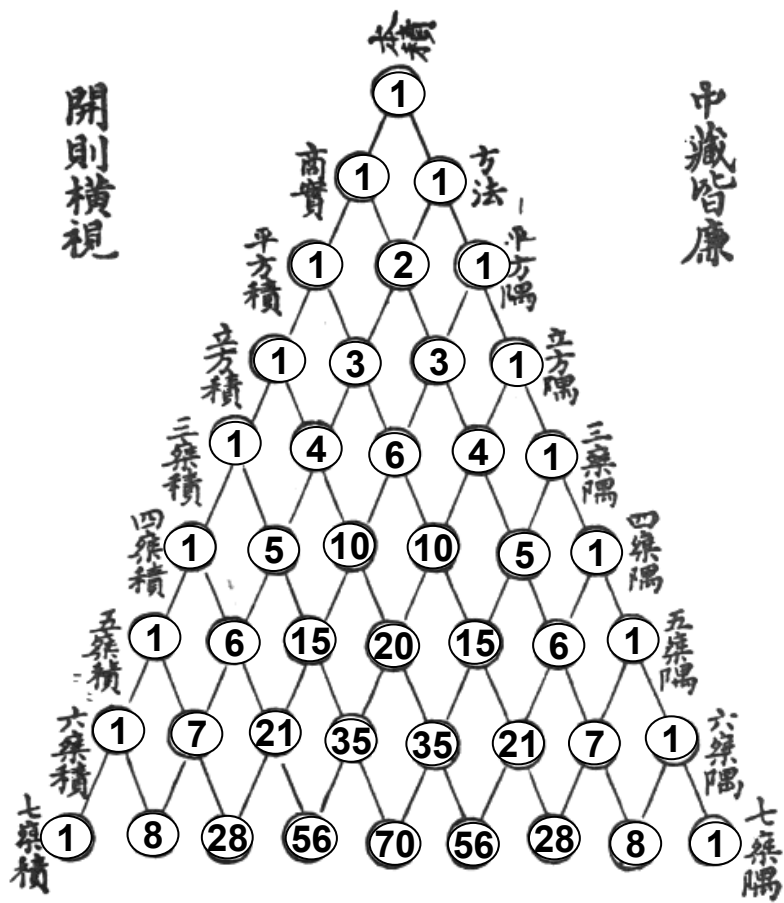
# 古法七藥方圖



七藥	六藥	五藥	四藥	三藥	二藥	一藥
----	----	----	----	----	----	----

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 10
- 15
- 20
- 21

# 古法七乘方圖

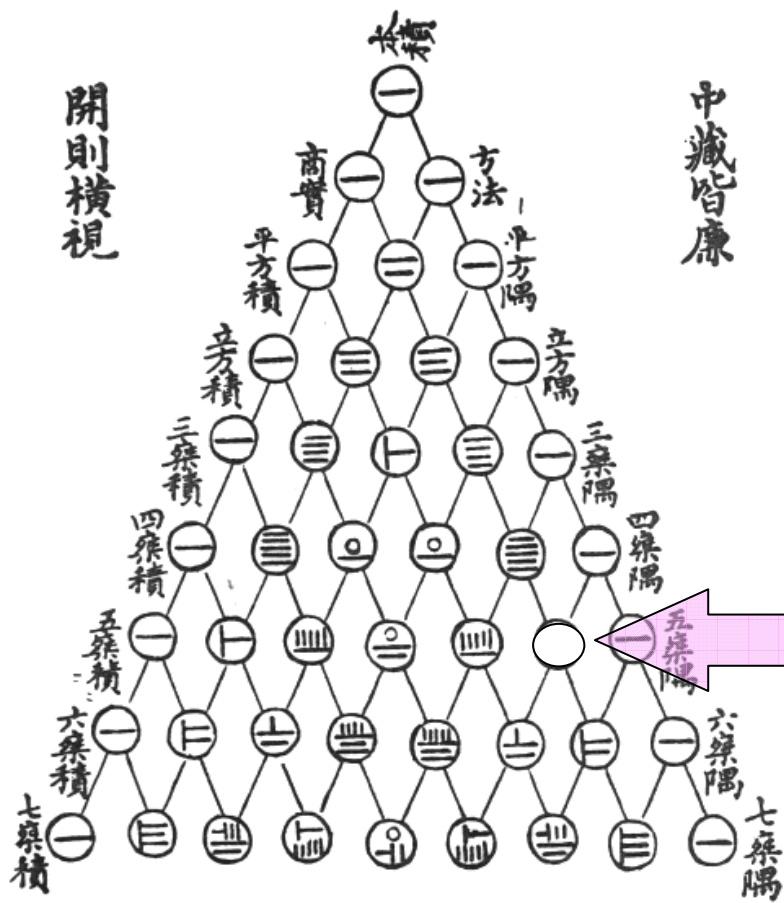


開則橫視

中藏皆廉

本積	方法	上廉	二廉	三廉	四廉	五廉	六廉	七廉
----	----	----	----	----	----	----	----	----

# 古法七乘方圖



開則橫視

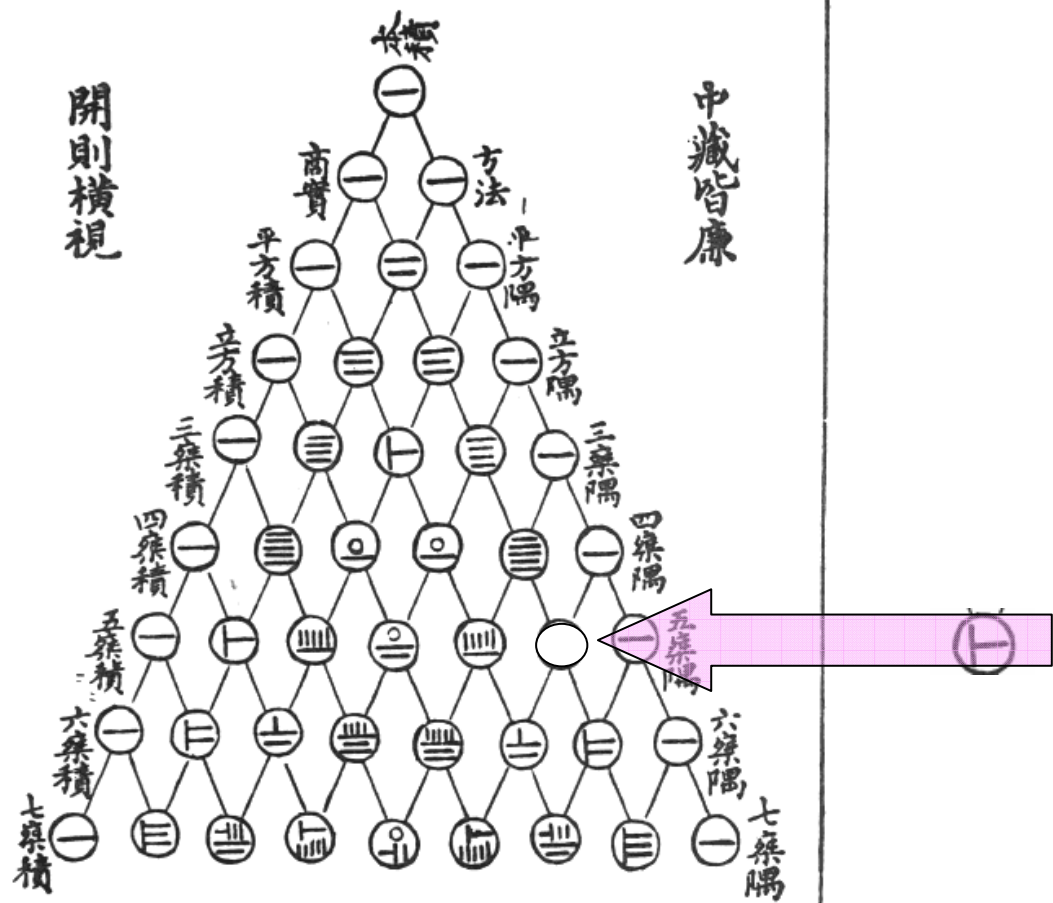
中藏皆廉



本積	方法	上廉	二廉	三廉	四廉	五廉	六廉	七廉
----	----	----	----	----	----	----	----	----



# 古法七乘方圖

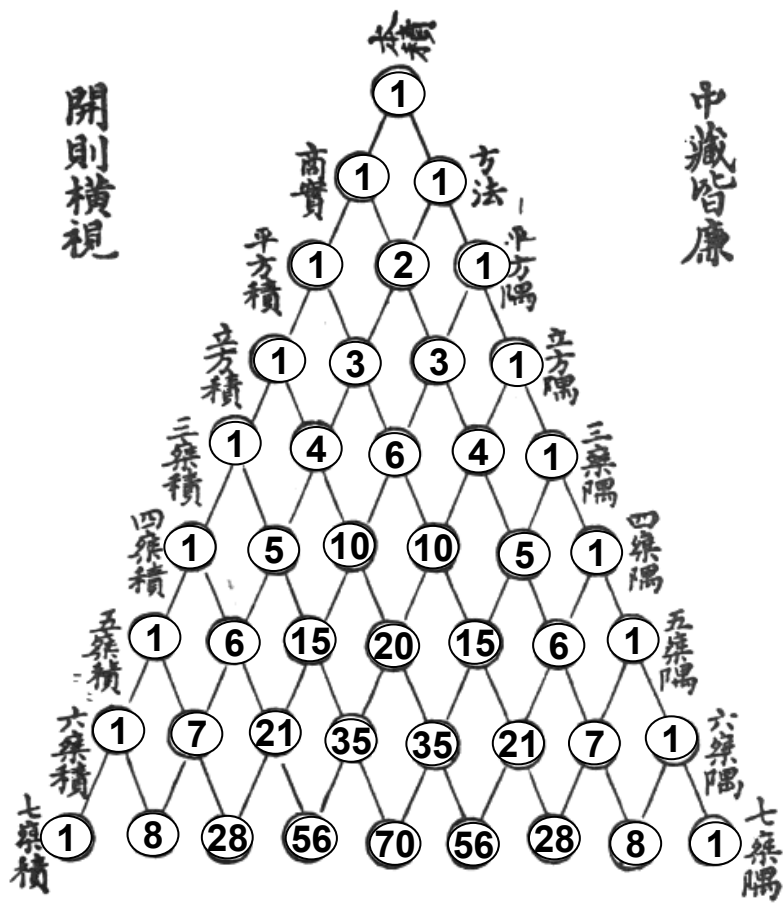


開則橫視

中藏皆廉

本積	方法	上廉	二廉	三廉	四廉	五廉	六廉	七廉
----	----	----	----	----	----	----	----	----

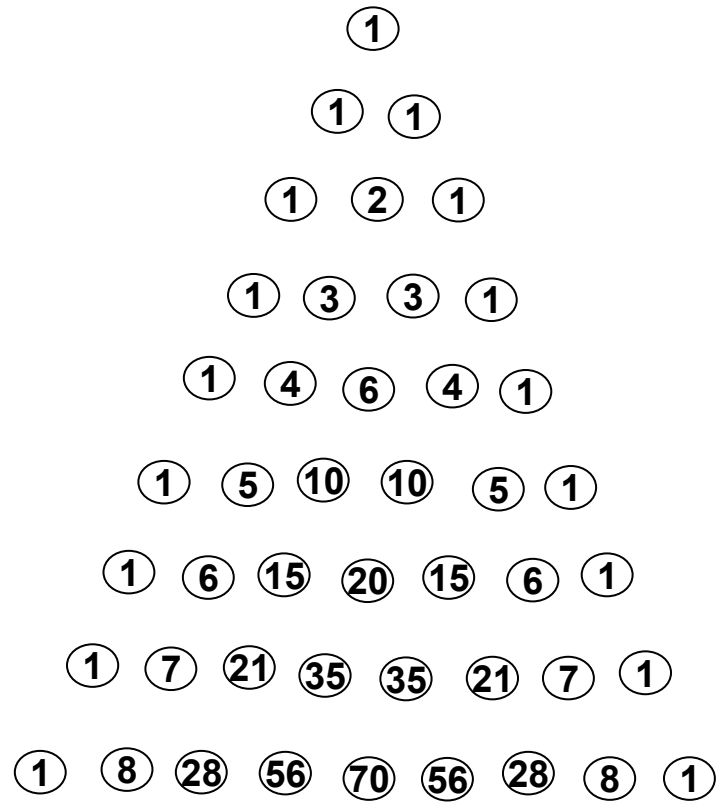
# 古法七乘方圖



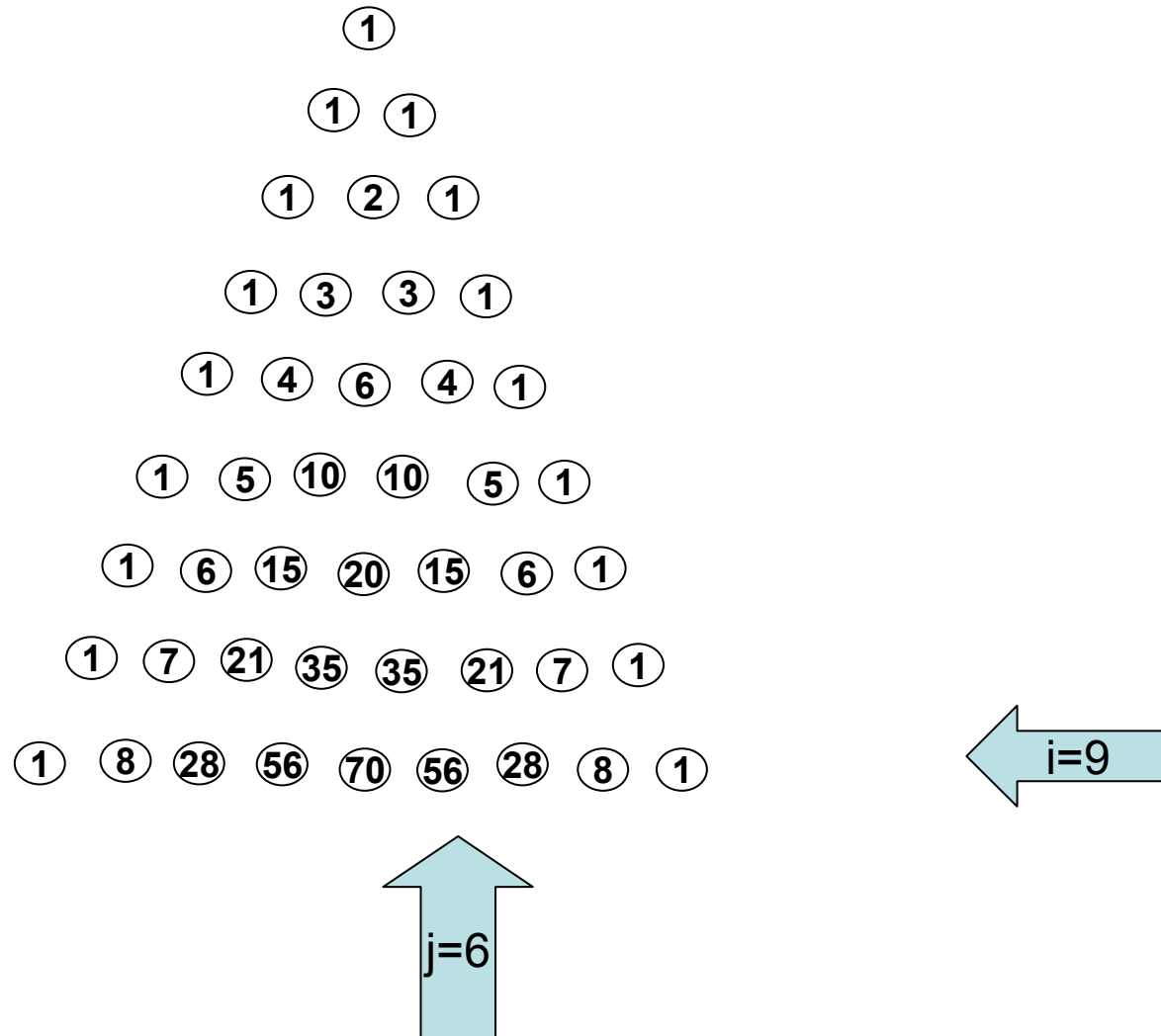
開則橫視

中藏皆廉

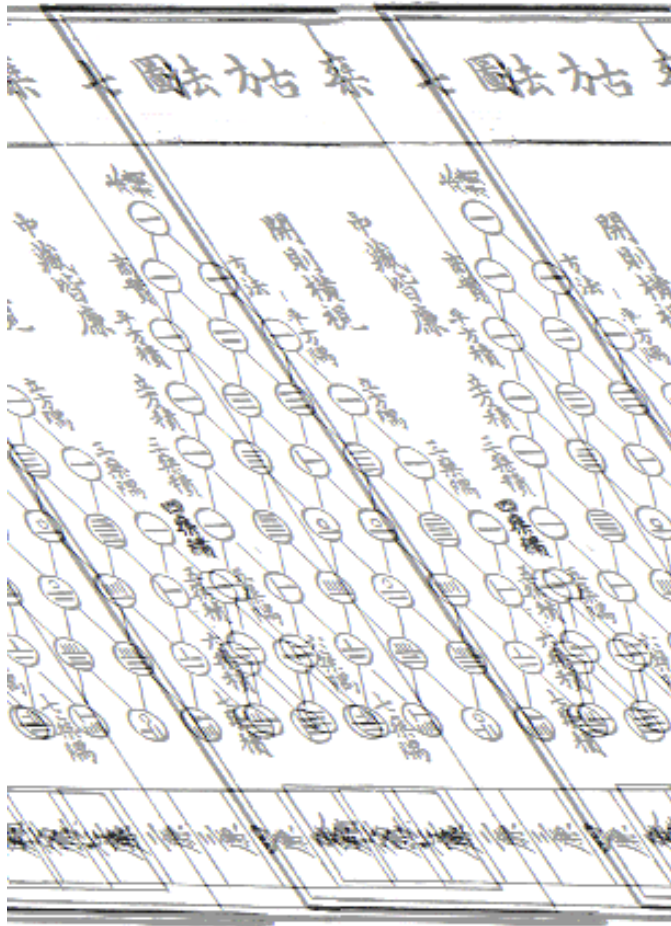
本積	方法	上廉	二廉	三廉	四廉	五廉	六廉	七廉
----	----	----	----	----	----	----	----	----



$$\binom{n}{k} = \frac{n \cdot (n-1) \cdots (n-k+1)}{k \cdot (k-1) \cdots 1} = \frac{n!}{k!(n-k)!} \quad \text{if } n \geq k \geq 0 \quad (1)$$



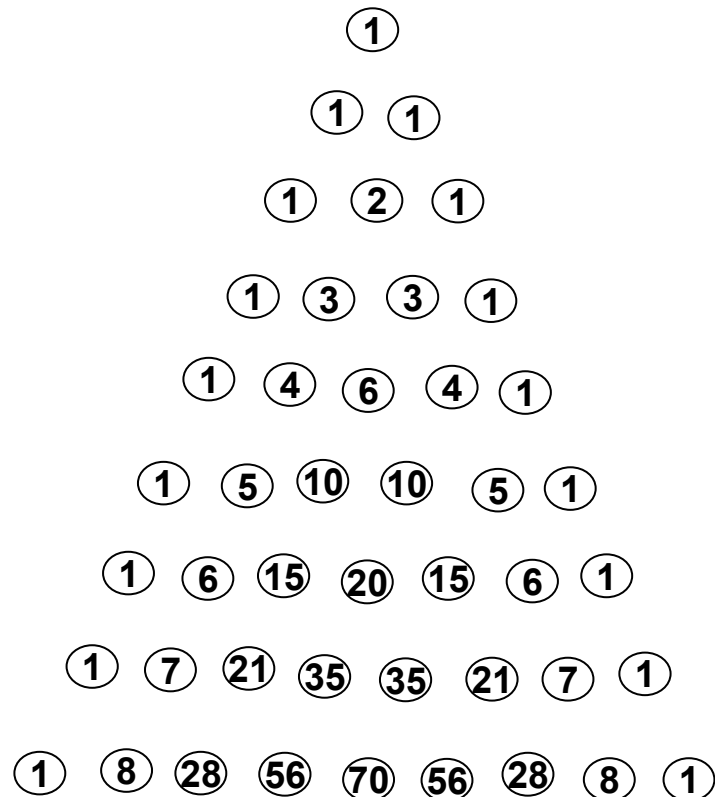
# Hypothesis



	1		7
	2		8
	3		10
	4		15
	5		20
	6		21

$$\binom{n}{k} = \frac{n \cdot (n-1) \cdots (n-k+1)}{k \cdot (k-1) \cdots 1} = \frac{n!}{k!(n-k)!} \quad \text{if } n \geq k \geq 0$$

# Patterns to...



- Compress
- Predict
- Correct
- Organize
- **Understand**

# Benefits of Detecting Patterns

## Periodic Table of the Elements

**Legend:**

- Alkali metals (Yellow)
- Alkaline earth metals (Light Yellow)
- Transition metals (Pink)
- Lanthanide series (Light Blue)
- Actinide series (Light Purple)
- Poor metals (Light Blue)
- Nonmetals (Light Green)
- Noble gases (Light Cyan)
- Solid (White)
- Liquid (Light Green)
- Gas (Light Yellow)
- Synthetic (Black)

1 1A H Hydrogen (1.00794)	2 2A He Helium (4.002602)											13 3A B Boron (10.81)	14 4A C Carbon (12.011)	15 5A N Nitrogen (14.007)	16 6A O Oxygen (15.999)	17 7A F Fluorine (18.998473)	18 8A Ne Neon (20.1797)
3 3A Li Lithium (6.941)	4 4A Be Beryllium (9.012182)	5 5A B Boron (10.81)	6 6A C Carbon (12.011)	7 7A N Nitrogen (14.007)	8 8A O Oxygen (15.999)	9 9A F Fluorine (18.998473)	10 10A Ne Neon (20.1797)	11 11A Na Sodium (22.989769)	12 12A Mg Magnesium (24.305)	13 3B Al Aluminum (26.981538)	14 4B Si Silicon (28.0855)	15 5B P Phosphorus (30.973762)	16 6B S Sulfur (32.06)	17 7B Cl Chlorine (35.45)	18 8B Ar Argon (39.948)		
19 1A K Potassium (39.0983)	20 2A Ca Calcium (40.078)	21 3B Sc Scandium (44.955912)	22 4B Ti Titanium (47.88)	23 5B V Vanadium (50.9415)	24 6B Cr Chromium (51.9961)	25 7B Mn Manganese (54.938045)	26 8B Fe Iron (55.845)	27 9B Co Cobalt (58.933200)	28 10B Ni Nickel (58.6934)	29 11B Cu Copper (63.546)	30 12B Zn Zinc (65.38)	31 13B Ga Gallium (69.723)	32 14B Ge Germanium (72.64)	33 15B As Arsenic (74.92160)	34 16B Se Selenium (78.96)	35 17B Br Bromine (79.904)	36 18B Kr Krypton (83.798)
37 1A Rb Rubidium (85.4678)	38 2A Sr Strontium (87.62)	39 3B Y Yttrium (88.90584)	40 4B Zr Zirconium (91.224)	41 5B Nb Niobium (92.90638)	42 6B Mo Molybdenum (95.94)	43 7B Tc Technetium (98)	44 8B Ru Ruthenium (101.07)	45 9B Rh Rhodium (101.07)	46 10B Pd Palladium (106.42)	47 11B Ag Silver (107.8682)	48 12B Cd Cadmium (112.41)	49 13B In Indium (114.818)	50 14B Sn Tin (118.710)	51 15B Sb Antimony (121.757)	52 16B Te Tellurium (127.6)	53 17B I Iodine (126.90545)	54 18B Xe Xenon (131.29)
55 1A Cs Cesium (132.90545)	56 2A Ba Barium (137.327)	57 to 71 Lanthanide series	72 4B Hf Hafnium (178.49)	73 5B Ta Tantalum (180.9479)	74 6B W Tungsten (183.84)	75 7B Re Rhenium (186.207)	76 8B Os Osmium (190.23)	77 9B Ir Iridium (192.22)	78 10B Pt Platinum (195.08)	79 11B Au Gold (196.96657)	80 12B Hg Mercury (200.59)	81 13B Tl Thallium (204.3833)	82 14B Pb Lead (207.2)	83 15B Bi Bismuth (208.9804)	84 16B Po Polonium (209)	85 17B At Astatine (210)	86 18B Rn Radon (222)
87 1A Fr Francium (223)	88 2A Ra Radium (226)	89 to 103 Actinide series	104 6B Rf Rutherfordium (261)	105 7B Db Dubnium (262)	106 8B Sg Seaborgium (263)	107 9B Bh Bohrium (264)	108 10B Hs Hassium (265)	109 11B Mt Meitnerium (266)	110 12B Ds Darmstadtium (267)	111 13B Rg Roentgenium (267)	112 14B Uub Ununbium (268)	113 15B Uut Ununtrium (269)	114 16B Uuq Ununquadium (269)	115 17B Uup Ununpentium (269)	116 18B Uuh Ununhexium (269)	117 19B Uuq Ununseptium (269)	118 18B Uuo Ununoctium (269)

Atomic masses in parentheses are those of the most stable or common isotopes.

**Lanthanide Series (57-71):** La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu

**Actinide Series (89-103):** Ac, Th, Pa, U, Np, Pu, Am, Cm, Bk, Cf, Es, Fm, Md, No, Lr

Note: The lanthanide numbers 1-18 were adopted in 1964 by the International Union of Pure and Applied Chemistry. The names of elements 112-118 use the IUPAC representatives of these numbers.

# Periodic Table of the Elements

1	New Original												13	14	15	16	17	18								
IA	IIA												IIIA	IVA	VA	VIA	VIIA	VIIIA								
1 <b>H</b> Hydrogen 1.00794																			2 <b>He</b> Helium 4.002602							
3 <b>Li</b> Lithium 6.941	4 <b>Be</b> Beryllium 9.012182																									
11 <b>Na</b> Sodium 22.989770	12 <b>Mg</b> Magnesium 24.3050	3 <b>B</b> Boron 10.811	4 <b>C</b> Carbon 12.0107	5 <b>N</b> Nitrogen 14.00674	6 <b>O</b> Oxygen 15.9994	7 <b>F</b> Fluorine 18.9984032	8 <b>Ne</b> Neon 20.1797	9 <b>Ar</b> Argon 39.948	10 <b>K</b> Potassium 39.0983	19 <b>Ca</b> Calcium 40.078	21 <b>Sc</b> Scandium 44.955910	22 <b>Ti</b> Titanium 47.867	23 <b>V</b> Vanadium 50.9415	24 <b>Cr</b> Chromium 51.9961	25 <b>Mn</b> Manganese 54.938040	26 <b>Fe</b> Iron 55.845	27 <b>Co</b> Cobalt 58.933200	28 <b>Ni</b> Nickel 58.6934	29 <b>Cu</b> Copper 63.546	30 <b>Zn</b> Zinc 65.409	31 <b>Ga</b> Gallium 69.723	32 <b>Ge</b> Germanium 72.64	33 <b>As</b> Arsenic 74.92160	34 <b>Se</b> Selenium 78.96	35 <b>Br</b> Bromine 79.904	36 <b>Kr</b> Krypton 83.798
37 <b>Rb</b> Rubidium 85.4678	38 <b>Sr</b> Strontium 87.62	39 <b>Y</b> Yttrium 88.90585	40 <b>Zr</b> Zirconium 91.224	41 <b>Nb</b> Niobium 92.90638	42 <b>Mo</b> Molybdenum 95.94	43 <b>Tc</b> Technetium (98)	44 <b>Ru</b> Ruthenium 98.907	45 <b>Rh</b> Rhodium 102.90550	46 <b>Pd</b> Palladium 106.42	47 <b>Ag</b> Silver 107.8682	48 <b>Cd</b> Cadmium 112.411	49 <b>In</b> Indium 114.818	50 <b>Sn</b> Tin 118.710	51 <b>Sb</b> Antimony 121.760	52 <b>Te</b> Tellurium 127.60	53 <b>I</b> Iodine 126.90447	54 <b>Xe</b> Xenon 131.29									
55 <b>Cs</b> Cesium 132.90545	56 <b>Ba</b> Barium 137.327	57 to 71	72 <b>Hf</b> Hafnium 178.49	73 <b>Ta</b> Tantalum 180.9479	74 <b>W</b> Tungsten 183.84	75 <b>Re</b> Rhenium 186.207	76 <b>Os</b> Osmium 190.23	77 <b>Ir</b> Iridium 192.227	78 <b>Pt</b> Platinum 195.078	79 <b>Au</b> Gold 196.96655	80 <b>Hg</b> Mercury 200.59	81 <b>Tl</b> Thallium 204.3833	82 <b>Pb</b> Lead 207.2	83 <b>Bi</b> Bismuth 208.98038	84 <b>Po</b> Polonium (209)	85 <b>At</b> Astatine (210)	86 <b>Rn</b> Radon (222)									
87 <b>Fr</b> Francium (223)	88 <b>Ra</b> Radium (226)	89 to 103	104 <b>Rf</b> Rutherfordium (261)	105 <b>Db</b> Dubnium (262)	106 <b>Sg</b> Seaborgium (266)	107 <b>Bh</b> Bohrium (264)	108 <b>Hs</b> Hassium (265)	109 <b>Mt</b> Meitnerium (268)	110 <b>Ds</b> Darmstadtium (271)	111 <b>Rg</b> Roentgenium (272)	112 <b>Jub</b> Jubilee (285)	113 <b>Uut</b> Ununtrium (284)	114 <b>Uuq</b> Ununquadium (288)	115 <b>Uup</b> Ununpentium (288)	116 <b>Uuh</b> Ununhexium (288)	117 <b>Uuq</b> Ununseptium	118 <b>Uuo</b> Ununoctium									

Atomic masses in parentheses are those of the most stable or common isotope.

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57 <b>La</b> Lanthanum 138.9055	58 <b>Ce</b> Cerium 140.116	59 <b>Pr</b> Praseodymium 140.90768	60 <b>Nd</b> Neodymium 144.24	61 <b>Pm</b> Promethium (145)	62 <b>Sm</b> Samarium 150.36	63 <b>Eu</b> Europium 151.964	64 <b>Gd</b> Gadolinium 157.25	65 <b>Tb</b> Terbium 158.92534	66 <b>Dy</b> Dysprosium 162.500	67 <b>Ho</b> Holmium 164.93032	68 <b>Er</b> Erbium 167.259	69 <b>Tm</b> Thulium 168.93421	70 <b>Yb</b> Ytterbium 173.04	71 <b>Lu</b> Lutetium 174.967
89 <b>Ac</b> Actinium (227)	90 <b>Th</b> Thorium 232.0381	91 <b>Pa</b> Protactinium 231.03688	92 <b>U</b> Uranium 238.02891	93 <b>Np</b> Neptunium (237)	94 <b>Pu</b> Plutonium (244)	95 <b>Am</b> Americium (243)	96 <b>Cm</b> Curium (247)	97 <b>Bk</b> Berkelium (247)	98 <b>Cf</b> Californium (251)	99 <b>Es</b> Einsteinium (252)	100 <b>Fm</b> Fermium (257)	101 <b>Md</b> Mendelevium (258)	102 <b>No</b> Nobelium (259)	103 <b>Lr</b> Lawrencium (262)

Note: The subgroup numbers 1-18 were adopted in 1984 by the International Union of Pure and Applied Chemistry. The names of elements 112-118 are the Latin equivalents of those numbers.



# Periodic Table of the Elements

1	2	New Original										13	14	15	16	17	18
IA	IIA											IIIA	IVA	VA	VIA	VIIA	VIIIA
1 <b>H</b> Hydrogen 1.00794																	2 <b>He</b> Helium 4.002602
3 <b>Li</b> Lithium 6.941	4 <b>Be</b> Beryllium 9.012182																10 <b>Ne</b> Neon 20.1797
11 <b>Na</b> Sodium 22.989770	12 <b>Mg</b> Magnesium 24.3050																18 <b>Ar</b> Argon 39.948
19 <b>K</b> Potassium 39.0983	20 <b>Ca</b> Calcium 40.078	21 <b>Sc</b> Scandium 44.955910	22 <b>Ti</b> Titanium 47.867	23 <b>V</b> Vanadium 50.9415	24 <b>Cr</b> Chromium 51.9961	25 <b>Mn</b> Manganese 54.938040	26 <b>Fe</b> Iron 55.845	27 <b>Co</b> Cobalt 58.933200	28 <b>Ni</b> Nickel 58.6934	29 <b>Cu</b> Copper 63.546	30 <b>Zn</b> Zinc 65.408	31 <b>Ga</b> Gallium 69.723	32 <b>Ge</b> Germanium 72.64	33 <b>As</b> Arsenic 74.92160	34 <b>Se</b> Selenium 78.96	35 <b>Br</b> Bromine 79.904	36 <b>Kr</b> Krypton 83.798
37 <b>Rb</b> Rubidium 85.4678	38 <b>Sr</b> Strontium 87.62	39 <b>Y</b> Yttrium 88.90585	40 <b>Zr</b> Zirconium 91.224	41 <b>Nb</b> Niobium 92.90638	42 <b>Mo</b> Molybdenum 95.94	43 <b>Tc</b> Technetium (98)	44 <b>Ru</b> Ruthenium 98.906	45 <b>Rh</b> Rhodium 102.90550	46 <b>Pd</b> Palladium 106.42	47 <b>Ag</b> Silver 107.8682	48 <b>Cd</b> Cadmium 112.411	49 <b>In</b> Indium 114.818	50 <b>Sn</b> Tin 118.710	51 <b>Sb</b> Antimony 121.757	52 <b>Te</b> Tellurium 127.60	53 <b>I</b> Iodine 126.90447	54 <b>Xe</b> Xenon 131.29
55 <b>Cs</b> Cesium 132.90545	56 <b>Ba</b> Barium 137.327	57 to 71	72 <b>Hf</b> Hafnium 178.49	73 <b>Ta</b> Tantalum 180.9479	74 <b>W</b> Tungsten 183.84	75 <b>Re</b> Rhenium 186.207	76 <b>Os</b> Osmium 190.23	77 <b>Ir</b> Iridium 192.227	78 <b>Pt</b> Platinum 195.078	79 <b>Au</b> Gold 196.96655	80 <b>Hg</b> Mercury 200.59	81 <b>Tl</b> Thallium 204.3833	82 <b>Pb</b> Lead 207.2	83 <b>Bi</b> Bismuth 208.98038	84 <b>Po</b> Polonium (209)	85 <b>At</b> Astatine (210)	86 <b>Rn</b> Radon (222)
87 <b>Fr</b> Francium (223)	88 <b>Ra</b> Radium (226)	89 to 103	104 <b>Rf</b> Rutherfordium (261)	105 <b>Db</b> Dubnium (262)	106 <b>Sg</b> Seaborgium (266)	107 <b>Bh</b> Bohrium (264)	108 <b>Hs</b> Hassium (265)	109 <b>Mt</b> Meitnerium (268)	110 <b>Ds</b> Darmstadtium (271)	111 <b>Rg</b> Roentgenium (272)	112 <b>Jub</b> Jubium (285)	113 <b>Uut</b> Ununtrium (284)	114 <b>Uuq</b> Ununquadium (289)	115 <b>Uup</b> Ununpentium (288)	116 <b>Uuh</b> Ununhexium (288)	117 <b>Uuo</b> Ununseptium (289)	118 <b>Uue</b> Ununoctium (289)

Atomic masses in parentheses are those of the most stable or common isotope.

Note: The subgroup numbers 1-18 were adopted in 1954 by the International Union of Pure and Applied Chemistry. The names of elements 112-118 are the Latin equivalents of those numbers.

57 <b>La</b> Lanthanum 138.905	58 <b>Ce</b> Cerium 140.116	59 <b>Pr</b> Praseodymium 140.90768	60 <b>Nd</b> Neodymium 144.24	61 <b>Pm</b> Promethium (145)	62 <b>Sm</b> Samarium 150.36	63 <b>Eu</b> Europium 151.964	64 <b>Gd</b> Gadolinium 157.25	65 <b>Tb</b> Terbium 158.92534	66 <b>Dy</b> Dysprosium 162.500	67 <b>Ho</b> Holmium 164.93032	68 <b>Er</b> Erbium 167.259	69 <b>Tm</b> Thulium 168.93421	70 <b>Yb</b> Ytterbium 173.04	71 <b>Lu</b> Lutetium 174.967
89 <b>Ac</b> Actinium (227)	90 <b>Th</b> Thorium 232.0381	91 <b>Pa</b> Protactinium 231.03688	92 <b>U</b> Uranium 238.02891	93 <b>Np</b> Neptunium (237)	94 <b>Pu</b> Plutonium (244)	95 <b>Am</b> Americium (243)	96 <b>Cm</b> Curium (247)	97 <b>Bk</b> Berkelium (247)	98 <b>Cf</b> Californium (251)	99 <b>Es</b> Einsteinium (252)	100 <b>Fm</b> Fermium (257)	101 <b>Md</b> Mendelevium (258)	102 <b>No</b> Nobelium (259)	103 <b>Lr</b> Lawrencium (262)

# Periodic Table of the Elements

**Legend:**

- Alkali metals (Orange)
- Alkaline earth metals (Yellow)
- Transition metals (Pink)
- Lanthanide series (Light Orange)
- Actinide series (Light Purple)
- Poor metals (Teal)
- Nonmetals (Light Green)
- Noble gases (Light Blue)

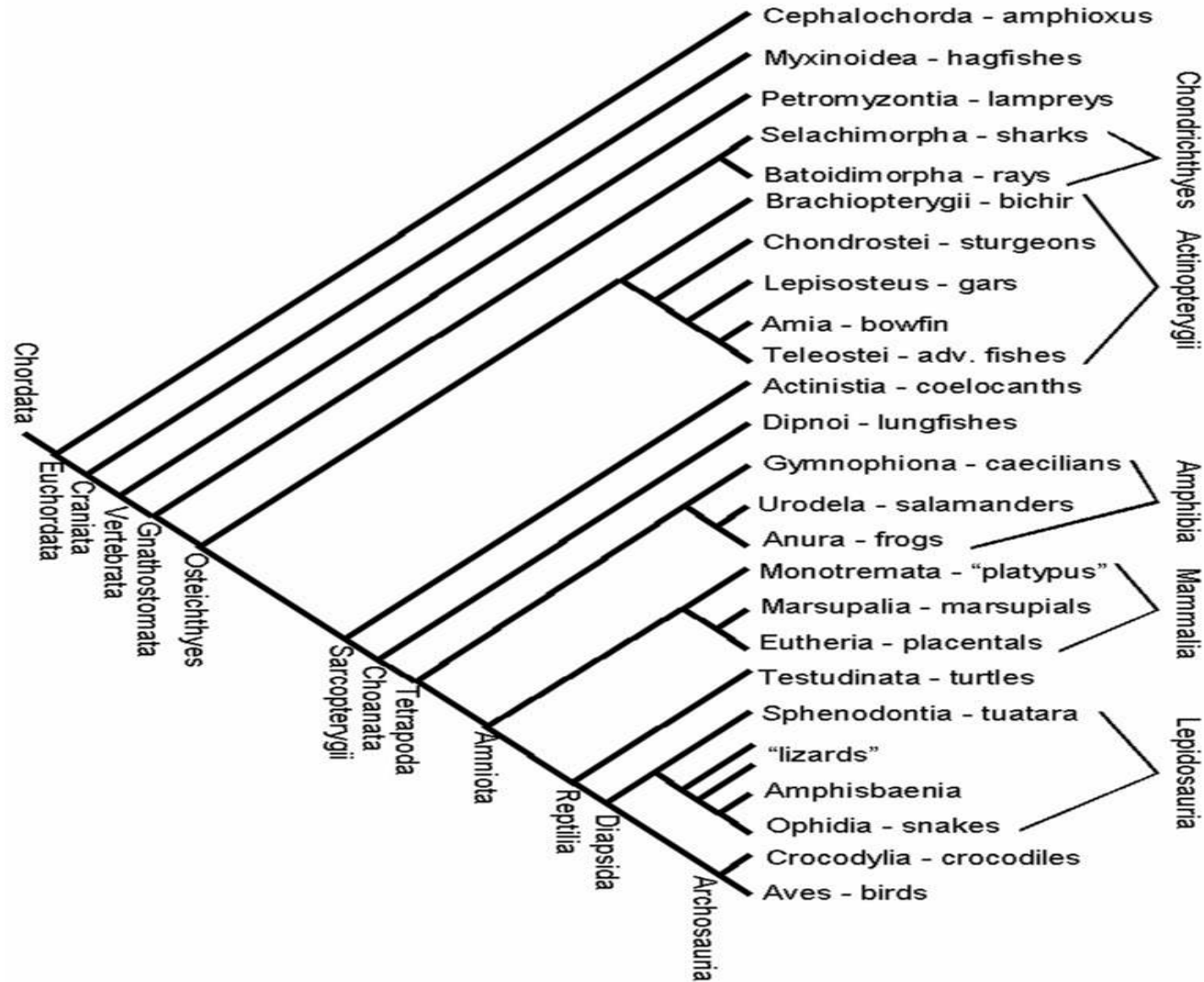
**Physical States:**

- C Solid
- Br Liquid
- H Gas
- Tc Synthetic

1 H Hydrogen 1.00794	2 He Helium 4.002602											13 B Boron 10.811	14 C Carbon 12.0107	15 N Nitrogen 14.00674	16 O Oxygen 15.9994	17 F Fluorine 18.9984032	18 Ne Neon 20.1797		
3 Li Lithium 6.941	4 Be Beryllium 9.012182											11 Cu Copper 63.546	12 Zn Zinc 65.408	13 Al Aluminum 26.9815386	14 Si Silicon 28.0855	15 P Phosphorus 30.973761	16 S Sulfur 32.06	17 Cl Chlorine 35.453	18 Ar Argon 39.948
19 K Potassium 39.0983	20 Ca Calcium 40.078	21 Sc Scandium 44.955912	22 Ti Titanium 47.867	23 V Vanadium 50.9415	24 Cr Chromium 51.9961	25 Mn Manganese 54.938044	26 Fe Iron 55.845	27 Co Cobalt 58.933195	28 Ni Nickel 58.6934	29 Cu Copper 63.546	30 Zn Zinc 65.408	31 Ga Gallium 69.723	32 Ge Germanium 72.64	33 As Arsenic 74.9216	34 Se Selenium 78.96	35 Br Bromine 79.904	36 Kr Krypton 83.798		
37 Rb Rubidium 85.4678	38 Sr Strontium 87.62	39 Y Yttrium 88.90585	40 Zr Zirconium 91.224	41 Nb Niobium 92.90638	42 Mo Molybdenum 95.94	43 Tc Technetium (98)	44 Ru Ruthenium 98.906	45 Rh Rhodium 102.9055	46 Pd Palladium 106.42	47 Ag Silver 107.8682	48 Cd Cadmium 112.411	49 In Indium 114.818	50 Sn Tin 118.710	51 Sb Antimony 121.757	52 Te Tellurium 127.6	53 I Iodine 126.90447	54 Xe Xenon 131.29		
55 Cs Cesium 132.90545	56 Ba Barium 137.327	57 to 71 Lanthanide series	72 Hf Hafnium 178.49	73 Ta Tantalum 180.9479	74 W Tungsten 183.84	75 Re Rhenium 186.207	76 Os Osmium 190.23	77 Ir Iridium 192.222	78 Pt Platinum 195.078	79 Au Gold 196.966569	80 Hg Mercury 200.59	81 Tl Thallium 204.3833	82 Pb Lead 207.2	83 Bi Bismuth 208.980386	84 Po Polonium (209)	85 At Astatine (210)	86 Rn Radon (222)		
87 Fr Francium (223)	88 Ra Radium (226)	89 to 103 Actinide series	104 Rf Rutherfordium (261)	105 Db Dubnium (262)	106 Sg Seaborgium (266)	107 Bh Bohrium (264)	108 Hs Hassium (265)	109 Mt Meitnerium (268)	110 Ds Darmstadtium (271)	111 Rg Roentgenium (272)	112 Jub Jubilee (285)	113 Uut Ununtrium (284)	114 Uuq Ununquadium (289)	115 Uup Ununpentium (288)	116 Uuh Ununhexium (289)	117 Uuo Ununseptium (289)	118 Uue Ununoctium (289)		
Atomic masses in parentheses are those of the most stable or common isotope.																			
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89 Ac Actinium (227)	90 Th Thorium 232.0381	91 Pa Protactinium 231.03688	92 U Uranium 238.02891	93 Np Neptunium (237)	94 Pu Plutonium (244)	95 Am Americium (243)	96 Cm Curium (247)	97 Bk Berkelium (247)	98 Cf Californium (251)	99 Es Einsteinium (252)	100 Fm Fermium (257)	101 Md Mendelevium (258)	102 No Nobelium (259)	103 Lr Lawrencium (262)					

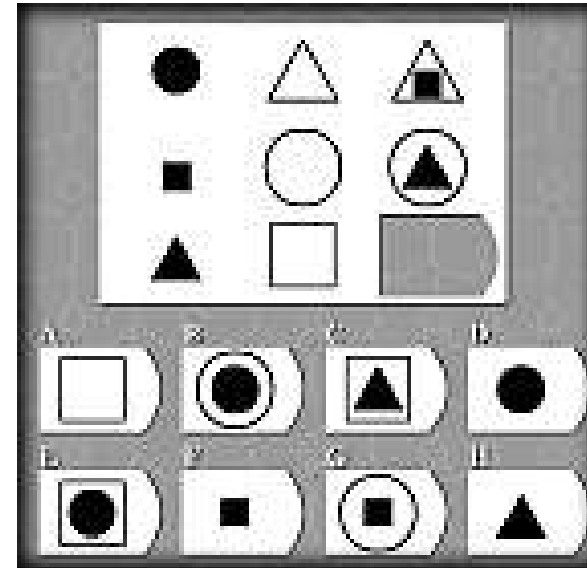
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# Benefits of Detecting Patterns



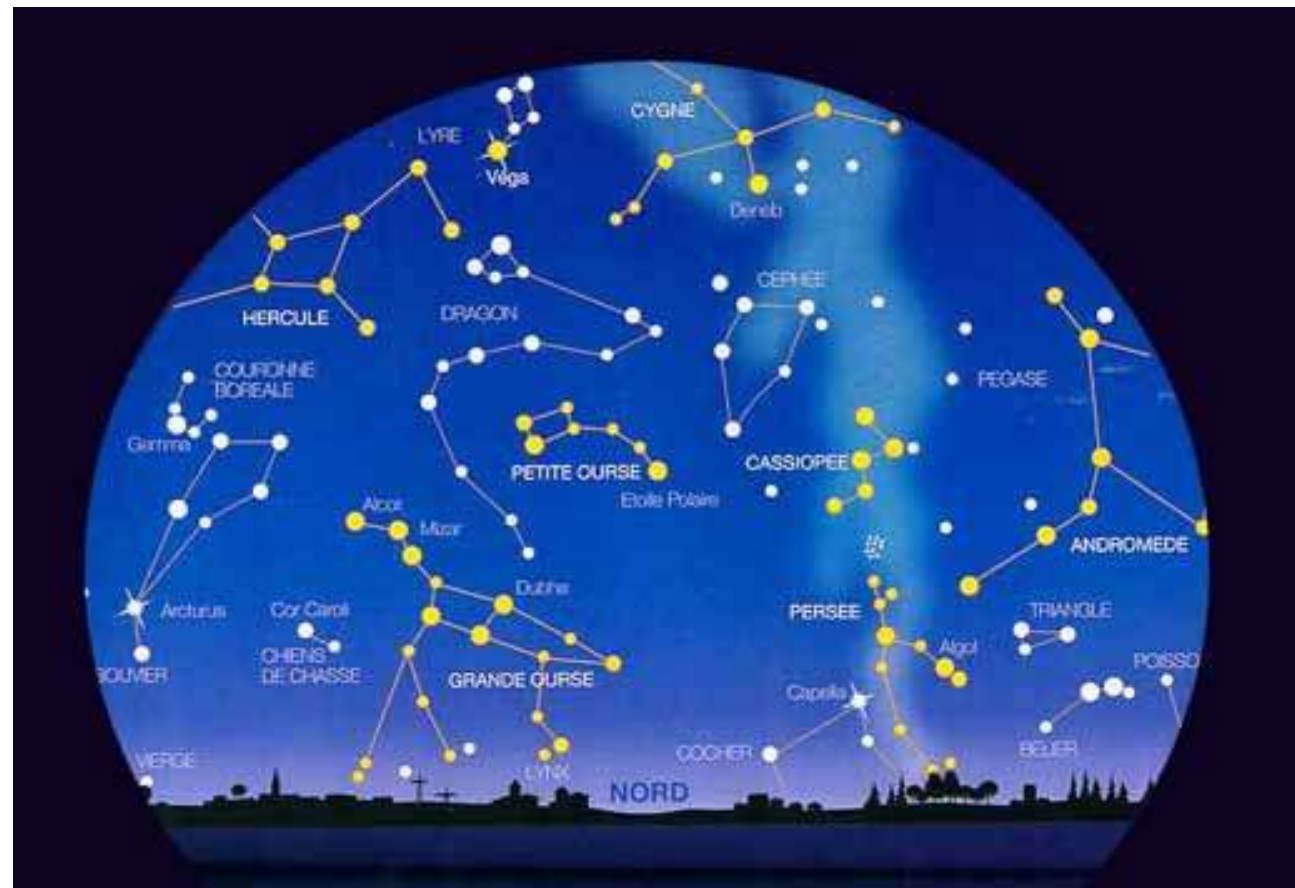
# Patterns and Intelligence

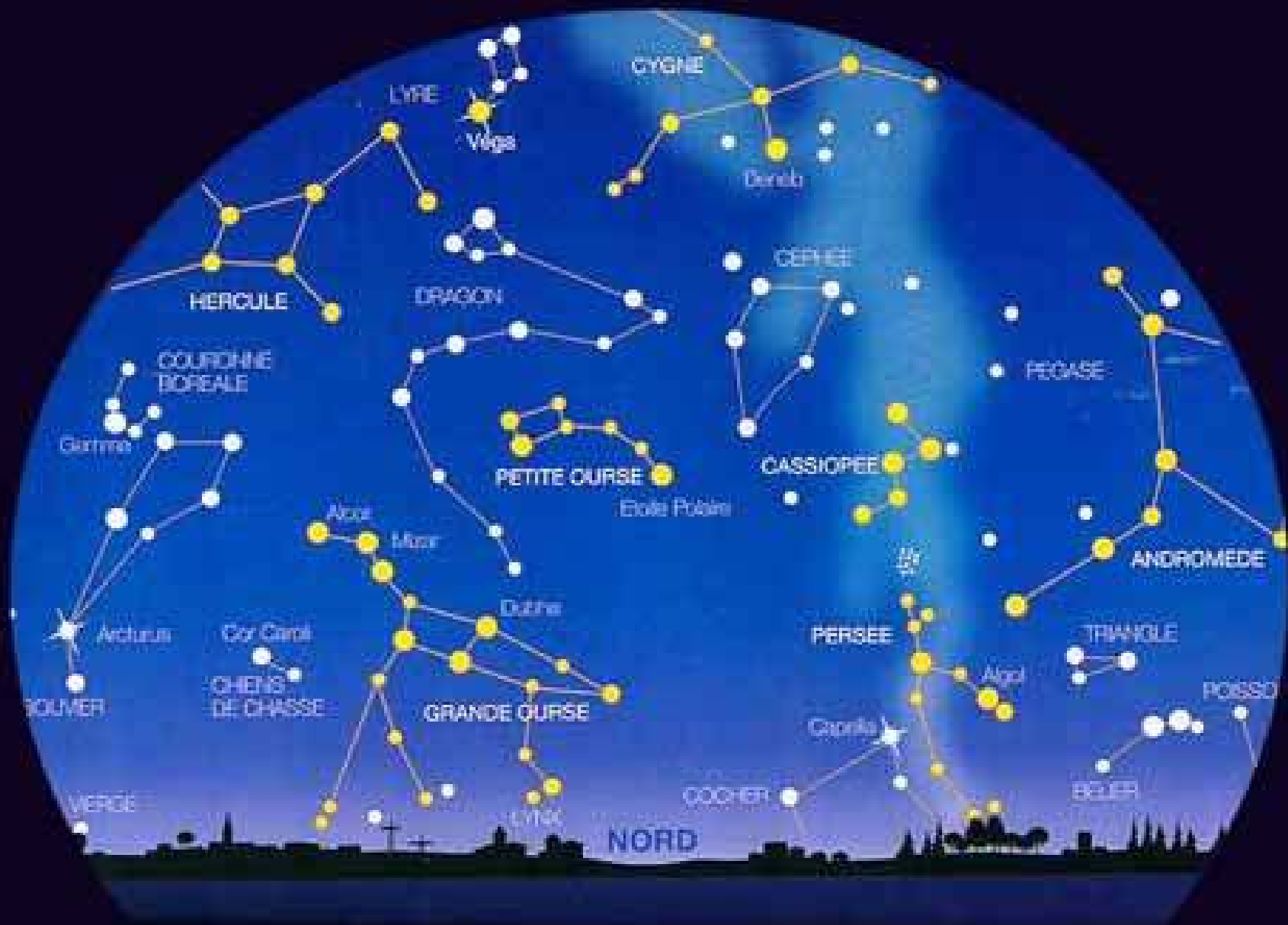
- We care so much about pattern finding skills, that we even use them (partly) to quantify intelligence...

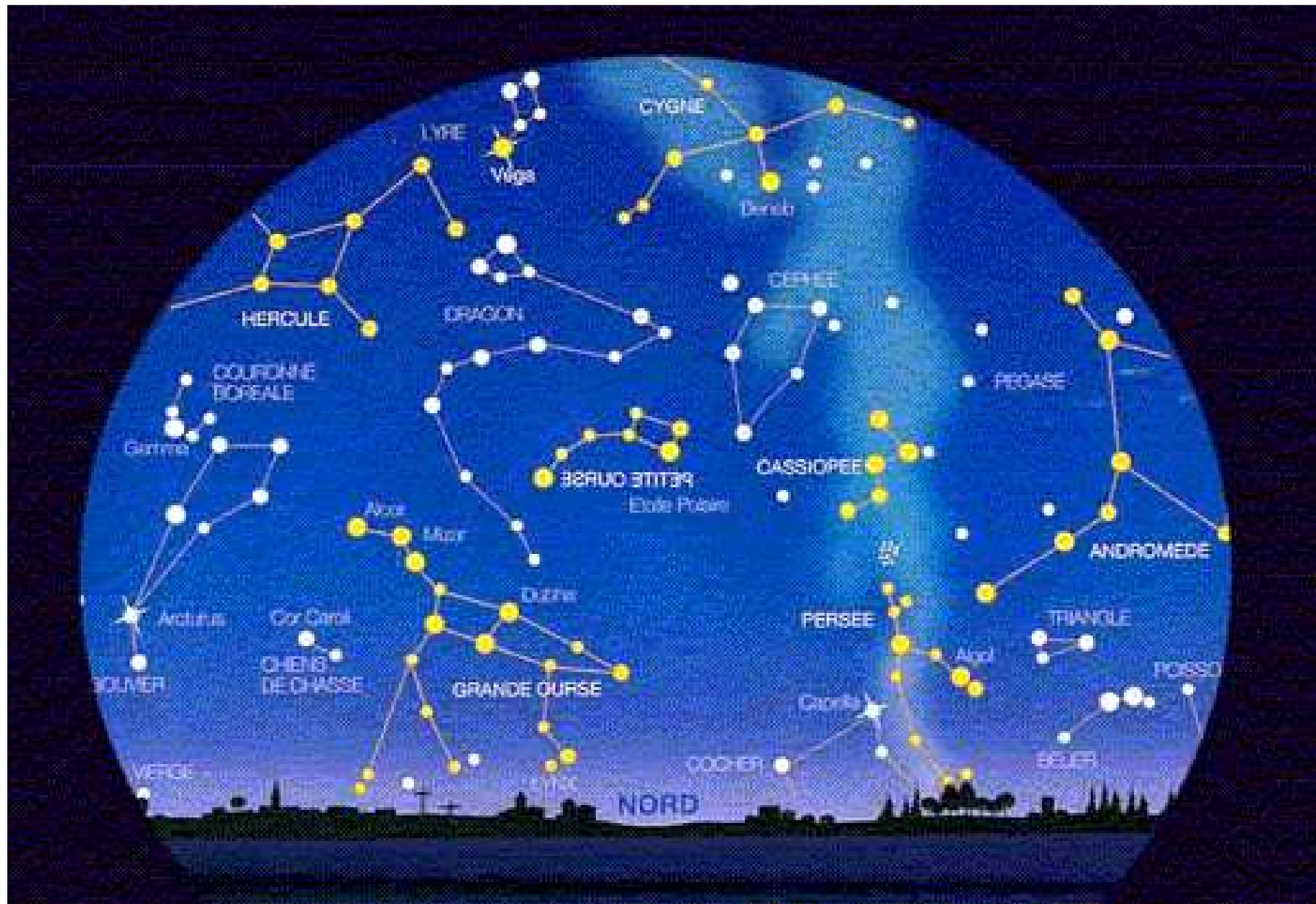


# The Instinct for Patterns

- We see patterns everywhere
- Even where there are no patterns:







# Patterns and Randomness

- We are poorly equipped to deal with randomness:
- 3.1415926535897932384626433832795028841  
97169399375105820974944592307816406286  
2089986280348253421170679...
- In first few millions of digits we could see your phone (and CC) numbers various times...
- Does it mean anything?





# Patterns and Randomness



- ABRAHAM LINCOLN WAS ELECTED TO CONGRESS IN 1846.
  - JOHN F. KENNEDY WAS ELECTED TO CONGRESS IN 1946.
  - 
  - ABRAHAM LINCOLN WAS ELECTED PRESIDENT IN 1860.
  - JOHN F. KENNEDY WAS ELECTED PRESIDENT IN 1960.
  - 
  - THE NAME LINCOLN AND KENNEDY EACH CONTAIN SEVEN LETTERS.
  - BOTH WIVES LOST CHILDREN WHILE LIVING IN THE WHITE HOUSE.
  - 
  - BOTH PRESIDENTS WERE SHOT ON FRIDAY.
  - BOTH WERE SHOT IN THE HEAD.
  - 
  - BOTH SUCCESSORS WERE NAMED JOHNSON.
- ANDREW JOHNSON, WHO SUCCEEDED LINCOLN, WAS BORN IN 1808.
  - LYNDON JOHNSON, WHO SUCCEEDED KENNEDY, WAS BORN IN 1908.
  - 
  - JOHN WILKES BOOTH, REPORTEDLY ASSASSINATED LINCOLN.
  - LEE HARVEY OSWALD, REPORTEDLY ASSASSINATED KENNEDY.
  - BOTH ASSASSINS WERE KNOWN BY THREE NAMES.
  - BOTH NAMES CONTAINED FIFTEEN LETTERS.
  - 
  - BOOTH AND OSWALD WERE ASSASSINATED BEFORE THEIR TRIALS.

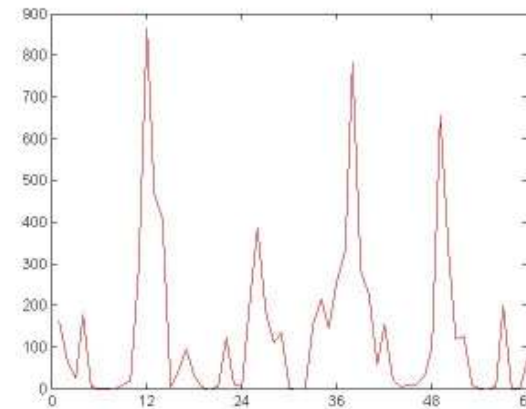
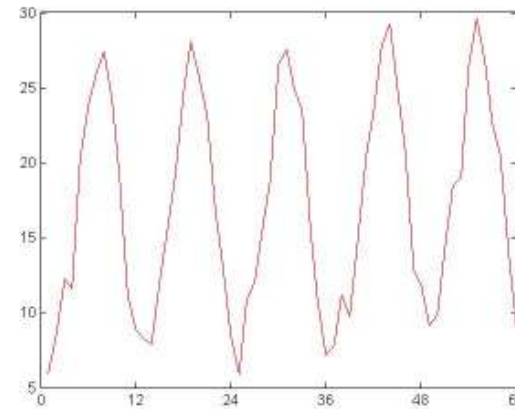
Coincidences ?

# Finding Patterns

- We are naturally interested in finding relations in data.
- We are naturally ill-equipped in dealing with randomness.
- We have developed sophisticated technology to do this for us.
- In last decade we have made one more step...
- As a society we *rely* on pattern discovery technology, in many ways

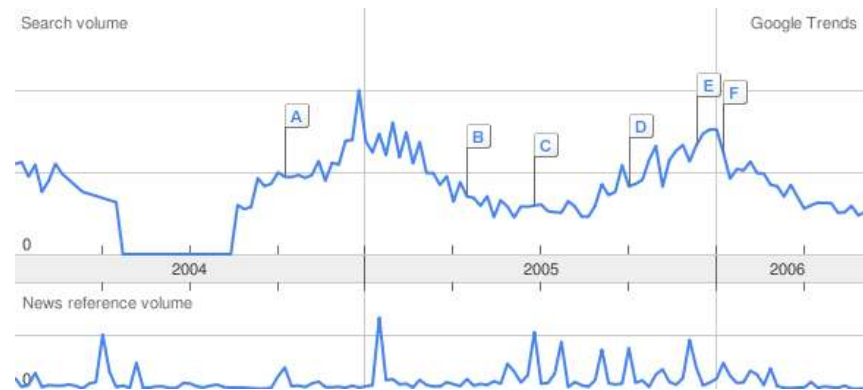
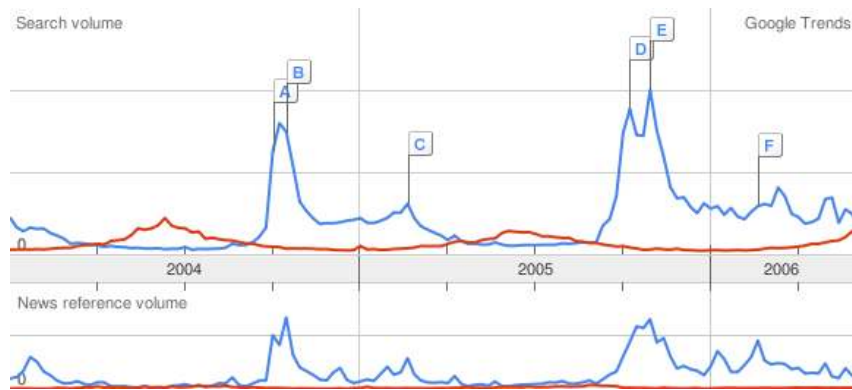
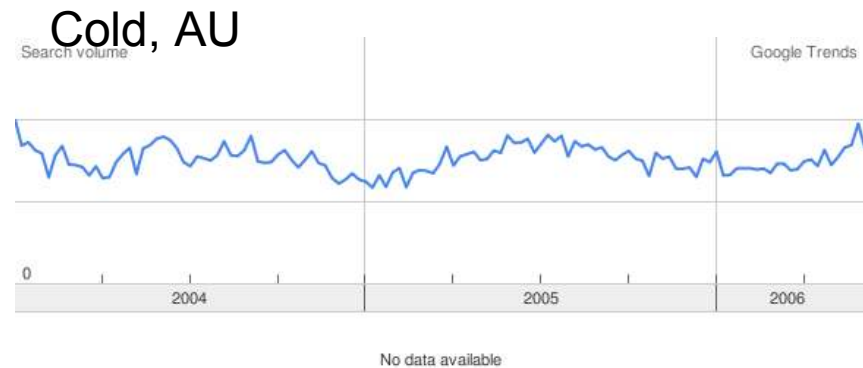
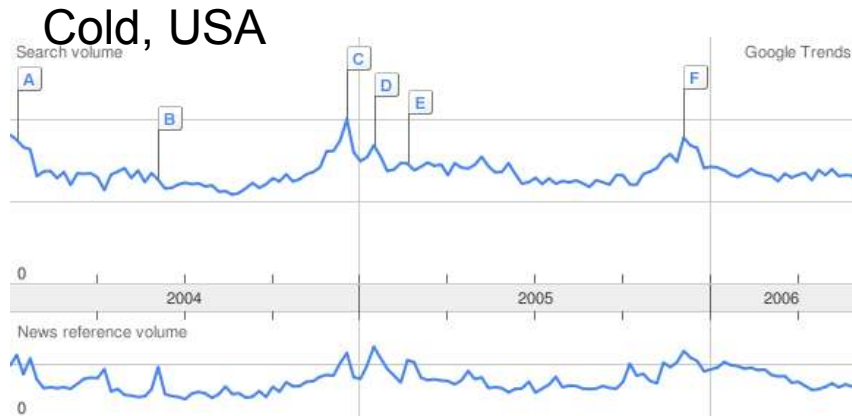
# Patterns in Natural Phenomena

- Patterns are everywhere, and people have always been fascinated by them.
- Detecting patterns confers an advantage to an organism



Temperature and Rainfall in Lake Shasta over 5 years

# Patterns in Collective Behavior



Flu, Mosquito, USA

Cold remedies, USA