Sets, logic, relations, numbers, combinatorics, probability

Sets:

Power set of set A is a set of all subsets of A.

Cardinality of power set is 2n, where n is cardinality of A.

Union of sets A and B is a set, which includes all elements of A and all elements of B.

Intersection of sets A and B is a set, which includes all elements, which are both in A and B.

Cardinality of union of A and B is equal to cardinality of A + cardinality of B - cardinality of intersection of A and B.

A – B means all elements which are in A but NOT in B.

Sets operations are similar to logical operations:

NOT for sets is NOT for logic,

intersection for sets is AND for logic,

union for sets is OR for logic.

Logic:

Compound propositions include 2 or more propositions.

Tautology: True (for any truth values of their variables)

Contradiction: False (for any truth values of their variables)

P OR NOT P is a tautology.

P AND NOT P is a contradiction.

IFF means if and only if:

If you study hard (H), then you will be rich (R) H 🡪 R and if you are rich (R), then you must have studied hard (H) R 🡪 H.

This means that if and only if you study hard (H), then you will be rich (R) H🡨🡪R

The truth table for IFF is:

|  |  |  |
| --- | --- | --- |
| H | R | H if and only if R |
| 0 | 0 | 1 |
| 0 | 1 | 0 |
| 1 | 0 | 0 |
| 1 | 1 | 1 |

H 🡪 R

Converse is: R 🡪 H

Inverse is: NOT H 🡪 NOT R

Contrapositive is: NOT R 🡪 NOT H

Question:

Compare truth tables of implication, conversion, inversion, contraposition.

Predicate is logical function.

Example x > 5, this true if x > 5 and false otherwise.

We proved by induction for predicate P(n).

If I am in Jakarta then I am on Java, if I am on Java then I am in Indonesia, therefore, if I am in Jakarta then I am in Indonesia.

Indonesia includes Java, Java includes Jakarta.

Argument

All humans are mammals.

I am a human; therefore, I am a mammal.

Incorrect argument:

All humans are mammals.

I am a mammal; therefore, I am a human.

Combinatorics:

If order matters, then we use permutations:

Question:

Calculate number of permutations L out of T: P(T,L).

I have million (106) options for my 6-digit pin-number.

Question:

How many options are for L decimal digits password?

Relation links sets.

Question:

Binary relation R on the set {1 to e+2} is defined so that *a*R*b* holds if and only if

 *a* divides *b*, with NO remainder. Find the matrix and draw the graph.

 Is it reflexive, symmetric, anti-symmetric, transitive, composite?

Question:

Find

Question:

Prove the Triangular Number expression .

Question:

Prove the expression for

https://calculus12s.weebly.com/uploads/2/5/3/9/25393482/p2integration2vs2summation.docx

Number theory:

Question:

Find Highest Common Divisor and Lowest Common Multiple of e+4 and L+4.

Question:

Convert T to e+2 and L+2 counting systems.

n = 100

b = 7

d1 = n Mod b ^ 1

MsgBox d1

d2 = (n Mod b ^ 2 - d1) / b ^ 1

MsgBox d2

d3 = (n Mod b ^ 3 - b ^ 1 \* d2 - d1) / b ^ 2

MsgBox d3

d4 = (n Mod b ^ 4 - b ^ 2 \* d3 - b ^ 1 \* d2 - d1) / b ^ 3

MsgBox d4

d5 = (n Mod b ^ 5 - b ^ 3 \* d4 - b ^ 2 \* d3 - b ^ 1 \* d2 - d1) / b ^ 4

MsgBox d5

d6 = (n Mod b ^ 6 - b ^ 4 \* d5 - b ^ 3 \* d4 - b ^ 2 \* d3 - b ^ 1 \* d2 - d1) / b ^ 5

MsgBox d6

d7 = (n Mod b ^ 7 - b ^ 5 \* d6 - b ^ 4 \* d5 - b ^ 3 \* d4 - b ^ 2 \* d3 - b ^ 1 \* d2 - d1) / b ^ 6

MsgBox d7

'd8 = (n Mod b ^ 8 - b ^ 6 \* d7 - b ^ 5 \* d6 - b ^ 4 \* d5 - b ^ 3 \* d4 - b ^ 2 \* d3 - b ^ 1 \* d2 - d1) / b ^ 7

'MsgBox d8

'd9 = (n Mod b ^ 9 - b ^ 7 \* d8 - b ^ 6 \* d7 - b ^ 5 \* d6 - b ^ 4 \* d5 - b ^ 3 \* d4 - b ^ 2 \* d3 - b ^ 1 \* d2 - d1) / b ^ 8

'MsgBox d9

'd10 = (n Mod b ^ 10 - b ^ 8 \* d9 - b ^ 7 \* d8 - b ^ 6 \* d7 - b ^ 5 \* d6 - b ^ 4 \* d5 - b ^ 3 \* d4 - b ^ 2 \* d3 - b ^ 1 \* d2 - d1) / b ^ 9

'MsgBox d10

Question:

Calculate the largest prime number you can using your own computer code.

n = 13

For i = 2 To Int(Sqr(n))

If n Mod i = 0 Then GoTo 1

Next i

MsgBox "prime"

GoTo 2

1 MsgBox "not prime"

2 Label2 = 2

Question:

Give prime factorization of s.

Dim p(9999), pf(9999)

mn = 2

nm = 9999

sn = 99107088

'

For i = 2 To Int(Sqr(sn))

If sn Mod i = 0 Then GoTo 11

Next i

MsgBox sn: MsgBox "is a prime number"

'Print #ii, sn, "is a prime number"

GoTo 333

11 abcdef = 1111

'nm = Int(Sqr(sn))

k = 0

For n = mn To nm

srn = Sqr(n)

isrn = Int(srn)

For i = 2 To isrn

If n Mod i = 0 Or srn = isrn Then GoTo 1

Next i

k = k + 1

p(k) = n

1 Next n

'

'MsgBox k

'

For i = 1 To k

'Print #ii, p(i)

Next i

For i = 1 To k

pf(i) = 0

Next i

srn = Sqr(sn)

isrn = Int(srn)

csn = sn

For i = 1 To k

Do While csn Mod p(i) = 0

csn = csn / p(i)

pf(i) = pf(i) + 1

Loop

111 Next i

For iiii = 2 To Int(Sqr(csn))

If csn Mod i = 0 Then GoTo 1111

Next iiii

ptc = 1

For i = 1 To k

'If pf(i) <> 0 Then ptc = ptc \* p(i) ^ pf(i): Print #ii, i, pf(i), p(i)

If pf(i) <> 0 Then ptc = ptc \* p(i) ^ pf(i)

'If pf(i) <> 0 Then Print #ii, p(i), "^", pf(i), "\*"

If pf(i) <> 0 Then MsgBox p(i): MsgBox "^": MsgBox pf(i): MsgBox "\*"

Next i

2 gfgfhgfdr = 5567

If ptc = 1 Then MsgBox sn: MsgBox "is a prime number": GoTo 333

ptc = ptc \* csn

'Print #ii, csn, "^ 1"

MsgBox csn: MsgBox "^ 1"

GoTo 22

1111 abcd = 1

For i = 1 To k

'Print #ii, i, pf(i), p(i)

Next i

22 gfgfhgfdr = 5567

'Print #ii, sn, ptc

If sn = ptc Then MsgBox "corrrect"

If sn <> ptc Then MsgBox "wrong"

333 Label = 333

Question:

Calculate C(9,e) and P(7,e). Give all the options for C(e+3,e).

Question:

In how many ways can you answer an exam with m+1 questions

 each of which has e+1 options for the answer?

Question:

Draw the histogram of tossing L+2 fair coins. Draw the histogram of the first e+3 digits of π.

Question:

Draw the histogram of adding random between e+2 times.

Question:

Give the histogram of Benford of the first digit of e+2 the most populated countries.

worldometers.info/world-population/population-by-country/