Discrete Math Mid-Term Exam made by Michael in May of 2017.

Each problem is the same number of marks.

Edited at 9am 9 May 2017.

s is your student number. k = s mod 10000. T = s mod 100. m = s mod 35. a = s mod 25.

L = s mod 10. $d\_{2}=\frac{T-L}{10}$. e = s mod 8. m7 = s mod 7. m6 = s mod 6. m4 = s mod 4. m3 = s mod 3.

m2 = s mod 2.

Sets:

1.1. How many subsets are there in a set of m elements?

http://discrete4math.weebly.com/uploads/2/5/3/9/25393482/1sets2017.ppt

Logic and proof:

http://discrete4math.weebly.com/uploads/2/5/3/9/25393482/2propositions.ppt

http://discrete4math.weebly.com/uploads/2/5/3/9/25393482/3proofs.ppt

http://discrete4math.weebly.com/uploads/2/5/3/9/25393482/4sequences.ppt

1.2. Give your own example of application of fuzzy logic.

2.1. Prove that $\sum\_{i=0}^{T}b^{i}=\frac{1-b^{T+1}}{1-b}$, b ≠ 1.

2.2. Prove the expression for $\sum\_{c=1}^{j}c^{L}$

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

2.3. Explain

m4 = 0: axiom.

m4 = 1: theorem.

m4 = 2: lemma.

m4 = 3: corollary.

2.4. Explain

m2 = 0: duality principle

m2 = 1: inclusion-exclusion principle

Relations:

http://discrete4math.weebly.com/uploads/2/5/3/9/25393482/5relations.ppt

http://discrete4math.weebly.com/uploads/2/5/3/9/25393482/9relations.ppt

3. Solve the relations problems.

3.1. 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 remainder. Find the matrix and draw the graph.

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

3.2. 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?

3.3. Combined relations.

Relation A:

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 remainder.

Relation B:

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 each combined relation.

Give the pairs.

Find the matrix and draw the graph.

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

m2 = 0: A and B.

m2 = 1: A or B.

3.4.

m2 = 0: Find A and B or A.

m2 = 1: Find B or A and B.

Matrices:

3.5. Matrices.

m2 = 0: Give main matrices operations

m2 = 1: What is symmetric and what is anti-symmetric matrix?

Number theory in discrete math:

http://discrete4math.weebly.com/uploads/2/5/3/9/25393482/6primes.ppt

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

Use all algorithms, which you can (Euclidean algorithm, etc.)

 http://discrete4math.weebly.com/uploads/2/5/3/9/25393482/euclidean4algorithm.txt

4.2. Convert T to e+2 and L+2 numeral systems.

http://discrete4math.weebly.com/uploads/2/5/3/9/25393482/number2convert.txt

5.1. Calculate the largest prime number you can.

http://discrete4math.weebly.com/uploads/2/5/3/9/25393482/primes2find.txt

5.1.2. Find the closest prime number to your s.

5.2. Give prime factorization of s.

http://discrete4math.weebly.com/uploads/2/5/3/9/25393482/prime4factorization4of4numbers.txt

5.3. Calculate.

a. s mod k

b. k mod T

c. T mod L

d. k mod m

e. s mod a

5.4.

m2 = 0: What is linear combination?

https://en.wikipedia.org/wiki/Linear\_combination

m2 = 1: Explain Chinese Remainder Theorem.

https://en.wikipedia.org/wiki/Chinese\_remainder\_theorem

5.5. Explain

m4 = 0: Hash function

m4 = 1: Cryptography

m4 = 2: Data Encryption Standard

m4 = 3: RSA

Combinatorics:

http://discrete4math.weebly.com/uploads/2/5/3/9/25393482/7combinatorics.ppt

6.1. Calculate C(9,e) and P(7,e).

6.2. Give all the options for C(e+3,e).

http://discrete4math.weebly.com/uploads/2/5/3/9/25393482/calculator4combinations.txt

7. In how many ways can you answer an exam with m+1 questions each of which has e+1 options for the answer?

7.2. Explain

m3 = 0: Multiplication Principle

m3 = 1: Addition Principle

m3 = 2: Pigeon Hole Principle

Discrete Probability:

http://discrete4math.weebly.com/uploads/2/5/3/9/25393482/8probability.ppt

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

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

http://www.worldometers.info/world-population/population-by-country/

Project:

10. Improve your project.