Guarantee of Integrity

I'm informed of all the regulations of exams and the corresponding punishments while violating them. I will abide by all the rules for exams and stay honest. Signature: ________

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Makeup Examination Paper of Northwestern Polytechnical University

Score:	

1st Semester of the Academic Year 2020-2021

Course School 2020 School of Computer Science

Course Name Discrete Mathmatics

Date of Exam 2020.12.9 Duration and time 2 hours

NOTICE：Write all answers on answer sheet.

I. Choose the right answer（2 points for each, total 20 points）

1. How many propositions in the following statements?

   1. Do not pass go. 2. The moon is made of green cheese.

   3. What time is it? 5. $4 + x = 5$

   6. Today is rain. 7.You are later for the exam.

   A.1 B. 2 C. 3 D. 4

2. Let p and q be the propositions

   p: Charry is good at Chinese: q: Charry is good at Mathematics

   Which one represent Charry is good at Chinese or she is good at Mathematics?

   A. $p \land q$ B. $p \lor q$ C. $p \rightarrow q$ D. $p \leftrightarrow q$

3. Let P(x) denote the statement “x passed the exam”, which represent at least one student didn’t in the class pass the exam?

   A. P(David) B. $\exists x P(x)$ C. $\forall x \neg P(x)$ D. $\exists x \neg P(x)$

4. What is the cardinality of $\{\varnothing, \{\varnothing\}, \{\varnothing, \varnothing\}\}$?

   A. 0 B. 1 C. 2 D. 3

5. Let f and g be the functions from the set of integers to the set of integers defined by $f(x) = 2x + 7$. What is the inverse function of f?

   A. 2x+7 B. 7-2x C. 1/2*(7-x) D. does not exist

6. How many rows appear in a truth table for the compound propositions?

   $(p \lor \neg q) \land (r \lor s)$

   A. 8 B.16 C.32 D.24

7. What is the negation of 2+2=5?

   A. 2+2=5 B. 2+3=5 C. 2+2=4 D. 2+2<>5

8. Decide which integer is remainder of -101 mod 11?

   A. -2 B. 2 C. -9 D. 9

9. Convert the binary expansion of $(10000000001)_2$ into hexadecimal expansion.

   A. $(101)_{16}$ B. $(201)_{16}$ C. $(301)_{16}$ D. $(401)_{16}$

10. How many functions are O(x)

    a) $f(x) = 10$ b) $f(x) = 3x + 7$ c) $f(x) = x^2 + x + 1$ d) $f(x) = 5\log x$ e) $f(x) = |x|$

    A. 2 B. 3 C.4 D. 5

II. Answer the question(6 points for each, total 36 points)

1. Suppose that the universal set is U = {1, 2, 3, 4,5, 6, 7, 8, 9, 10}. Express each of these sets with bit strings where the ith bit in the string is 1 if i is in the set

and 0 otherwise.

a) {4, 5} b) { 1, 3, 10} c) {2, 4, 7, 8, 9}

2. Let S = {−1, 0, 1,2, 4, 7}. Find f (S) if

   a) $f(x) = 1$. b) $f(x) = 3x + 1$. C) $f(x) = x^2+2x+1$

3. Find the inverse of 7 modulo 26.

4. Periodicals are identified using an International Standard Serial Number (ISSN). An ISSN consists of two blocks of four digits. The last digit in the second block is a check digit. This check digit is determined by the congruence $d8 \equiv 3d1 + 4d2 + 5d3 + 6d4 + 7d5 + 8d6 + 9d7 \pmod{11}$. When $d8 \equiv 10 \pmod{11}$, we use the letter X to represent d8 in the code.

   1) Determine the last number of 1570-868 .
   2) Check if 1059-1027 is an valid ISSN.

5. Use the Euclidean algorithm to find gcd(1529, 14039).

6. How many solutions does the equation $x1+x2+x3 =15$ have, where x1, x2 and x3 are natural numbers?

III. Proof(4 points for No.1, 8 points for each of others, total 44 points)

1. Show that $(p \vee q) \wedge (\neg p \vee r) \rightarrow (q \vee r)$ is a tautology.
2. Devise an algorithm that finds the min number of all the integers in a list.
3. Prove that 5 divides $n^5 - n$ whenever n is a nonnegative integer.
4. Use mathematical induction to prove following statement.

$$1+\frac{1}{4}+\frac{1}{9}+\cdots+\frac{1}{n^2}<2-\frac{1}{n},$$

5. Prove that there are no solutions in integers x and y to the equation $2x^2 + 5y^2 = 16$.
6. Prove that if n is a positive integer, then n is even if and only if $7n + 4$ is even.