

Second Class Test Problems

Test Information

The second COMP109 class test will be held on

Wednesday, 13 December 2017 at 10:00 in SCTH-MR

(that is, in the normal lecture time and location). The test duration is 50 minutes. The test is closed book, so no unauthorised materials including lecture notes, problem solutions, tutorial sheets, books, etc are permitted. The test is multiple choice.

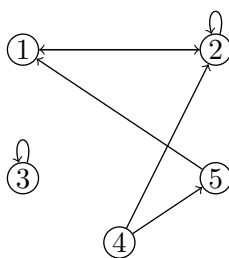
Problems for the test (but not the multiple choice options) are made available in advance. **All** of the problems listed below will appear in the test; however, the numeric values in some of the actual test questions may differ from the ones below. There will be no written part in the second test. Some problems may contribute to more than one MCQ.

In addition, there will be 4 unseen problems.

You will need a pencil to mark your answer on the computer sheet.

Problems

1. Let $A = \{2, 3\}$ and $B = \{a, b, c\}$. List the elements of $A \times B$.
2. Let $|A| = m$ and $|B| = n$. What is the cardinality of the set $A \times B$?
3. List the set of ordered pairs of the relation R represented by the following digraph.



4. Let $A = \{a, b, c\}$, $B = \{1, 2, 3, 4\}$ and $C = \{3, 4, 5\}$.
 - List the set of ordered pairs of the relation R between A and B represented by the following matrix.

$$M = \begin{bmatrix} F & T & T & T \\ F & F & T & T \\ F & F & T & T \end{bmatrix}$$

- Let $S \subseteq B \times C$ be given by

$$S = \{(x, y) \mid x < y\}.$$

List the set of ordered pairs in the inverse relation S^{-1} of S .

- Compute the matrix representation of $S \circ R$.

5. Let $T = \{(2, 3), (1, 2), (3, 1)\}$. List the set of ordered pairs in the transitive closure of T .

6. Which of the following sentences are propositions?

- | | |
|--------------------------------------|------------------|
| (1) A banana is larger than its skin | (4) $2 + 3 = 5$ |
| (2) London is the capital of Paris | (5) $5 + 7 = 10$ |
| (3) Answer this question | |

7. Which of the following are true?

- | | |
|--|--|
| • $(p_0 \vee p_1) \equiv (p_0 \wedge p_1)$ | • $(p_1 \wedge (p_0 \rightarrow p_1)) \equiv \neg p_0$ |
| • $(p_0 \wedge (p_0 \rightarrow p_1)) \equiv p_1$ | • $(p_0 \wedge p_1) \equiv (p_0 \wedge (p_0 \rightarrow p_1))$ |
| • $(p_0 \rightarrow p_1) \equiv (\neg p_1 \vee p_0)$ | |

8. For the table below construct a circuit having the given table as its input/output table

P	Q	R	S
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	1

- Represent 183 in binary notation.
- What is the 4-bit two's complement of 5.
- Using the 4-bit representation compute the sum $4 + (-5)$.
- A password consists of three lower-case letters (from 'a' to 'z') followed by a three-digit number. The three-digit number must start with '0' or with '1' or with '2'. How many such passwords are there?
- In how many ways can a 2-person subcommittee be chosen from a 6-person committee?
- How many length 4 sequences of distinct digits are there?
- What is the coefficient of x^5 in $(1 + x)^8$?