CSE215
Foundations of Computer Science

State University of New York, Korea

Plan

- Review with mock Midterm 1 exam

- Note: mock exam and real exam can be quite different

Mock Midterm

Problem 1.

Determine if the following are true or not

1. The two formulas are equivalent:
   $(p \vee \neg p)$ and $true$.
2. The two formulas are equivalent:
   $p \wedge (q \vee r)$ and $(p \wedge q) \vee (p \wedge r)$.
3. The two formulas are equivalent:
   $\neg(p \vee q)$ and $\neg p \wedge \neg q$.
4. The two formulas are equivalent:
   $(p \vee q) \rightarrow r$ and $(p \rightarrow r) \wedge (q \rightarrow r)$.
5. The two formulas are equivalent:
   $(p \rightarrow q) \vee (q \rightarrow p)$ and $true$.
6. The two formulas are equivalent:
   $p \wedge (p \rightarrow q)$ and $p \wedge q$.
7. The two formulas are equivalent:
   $(p \vee q) \wedge \neg(p \wedge q)$ and $p \oplus q$, where $\oplus$ is exclusive or.
8. The two formulas are equivalent:
   $p \wedge (\neg p \vee q)$ and $p \wedge q$.
9. The two formulas are equivalent:
   $\neg(p \rightarrow q)$ and $p \wedge \neg q$.
10. The two formulas are equivalent:
    $(p \rightarrow q) \wedge \neg p$ and $\neg p$.

Problem 2.

Negate the following statements.

1. For any integer a, if a is odd then a^2 is odd.

2. For every prime number p, there is another prime number q such that $q > p$.

3. If x is prime, then x is not a multiple of 2.

4. For every positive number ε, there is a positive number M, such that $|f(x) - b| < \varepsilon$ whenever $x > M$.

[Hint: "whenever" here has the same meaning as "if".]

Problem 3.

Is the following argument valid or invalid? **Please explain using appropriate inference rules**. To clarify your reasoning, it is recommended to structure your explanation like this: From ... and ..., we get ... based on ...

1. $b \vee \sim a \rightarrow c$
2. $\sim b \vee d$
3. $\sim e$
4. $c \wedge \sim a \rightarrow \sim d$
5. $a \rightarrow e$
6. $\therefore \sim b$

Problem 4.

Which arguments below are valid? There can be zero, one, or more than one choice. You do not need to explain. All points will be lost if there is an error in your answer.

(1)

Premises:

- If Adam is innocent, Adam will not be punished.
- Adam is innocent.

Conclusion: Adam will not be punished.

(2)

Premises:

- If Adam is innocent, Adam will not be punished.
- Adam will be punished.

Conclusion: Adam is not innocent

(3)

Premises:

- If Adam is innocent, Adam will not be punished.
- Adam is not innocent.

Conclusion: Adam will be punished.

(4)

Premises:

- If Adam is innocent, Adam will not be punished.
- Adam will not be punished.

Conclusion: Adam is innocent.

Problem 5.

1. Determine whether $(p \wedge (p \oplus q)) \rightarrow \sim q$ is a tautology or not. Please justify your answer with explanations.

2. Determine if this argument below is valid or not. Please justify your answer with explanations.

    - premmise $p \rightarrow r$
    - premise $q \rightarrow r$
    - conclusion $(p \vee q) \rightarrow r$

3. Determine if $P \rightarrow Q$ and $(P \wedge \sim Q) \rightarrow (Q \wedge \sim Q)$ are equivalent or not. Please justify your answer with explanations.