Instructions

Below are 12 practice exam problems which you must turn in when you come in to take the exam; these must be written up neatly or typed on separate paper and in accordance with the guidelines in your syllabus. Your grade will be based on you completing all the questions and on the quality of your work. In addition there is a long list of practice problems from the text which you do not need to turn in but are representative of the sorts of questions which may be on the exam.

Practice Exam Problems:

1. Write the negation of the following statement:

$$(x > 100 \text{ OR } y < -500) \text{ AND } x < 100$$

2. Supply justification for each step.

$$
\begin{aligned}
(1) \qquad (p \wedge \sim q) \vee (p \wedge q) &\equiv p \wedge (\sim q \vee q) \\
(2) \qquad &\equiv p \wedge (q \vee \sim q) \\
(3) \qquad &\equiv p \wedge t \\
(4) \qquad &\equiv p \\
(5) \qquad \therefore (p \wedge \sim q) \vee (p \wedge q) &\equiv p
\end{aligned}
$$

3. Rewrite the following statement as an if then statement in two different ways (you will need to use the contrapositive).

"A fiddle in your band is a necessity, if you are going to play in Texas."

4. Use a truth table to determine if the argument form is valid:

$$
\begin{aligned}
p &\rightarrow q \\
q &\rightarrow p \\
\therefore p &\vee q
\end{aligned}
$$

5. Find the truth set for the predicate:

$$P(x): \ 1 \le x^2 \le 4$$

where $x \in \mathbb{R}$.

6. Give a counter example to the statement:

$$\forall x \in \mathbb{R}, x > 1/x$$

7. Write the *converse, inverse, contrapositive,* and, *negation* of

$$\forall x \in \mathbb{R}, (x^2 \ge 1) \rightarrow (x > 0)$$

8. For the following identify which is an example *Modus Ponens*, *Modus Tollens*, *Converse Error*, and *Inverse Error*.

(a) All happy people clap their hands.
Gabe claps his hands.
∴ Gabe is happy.

(b) All happy people clap their hands.
Josie is a happy person.
∴ Josie claps her hands.

(c) All happy people clap their hands.
Chuck does not clap his hands.
∴ Chuck is not happy.

(d) All happy people clap their hands.
Ian is not a happy person.
∴ Ian does not clap his hands.

Problems 9 to 12 refer to the Tarski Square given here. Determine if each statement is true or false and rewrite the given statement in formal logical notation.
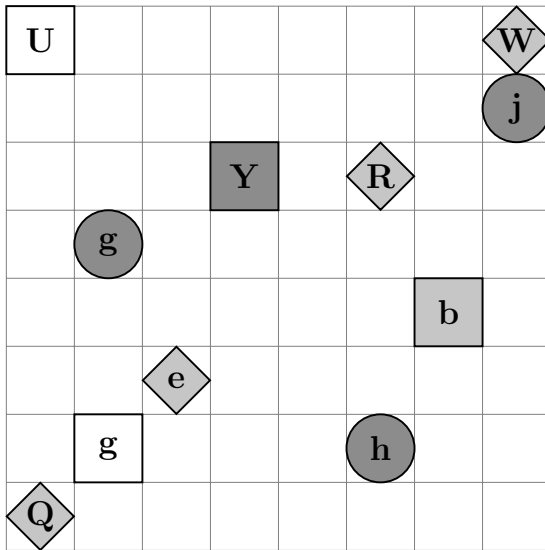
- *C(x): x is a circle*
- *D(x): x is a diamond*
- *S(x): x is a square*
- *G(x): x is gray*
- *B(x): x is black*
- *W(x): x is white*
- *V(x): x is a vowel*
- *L(x): x is lowercase*
- *F(x): x comes before N*
- *R(x,y): x is to the right of y*
- *A(x,y): x is higher up than y*

9. There exists a circle to the right of all the squares.

10. There exists a white circle.

11. All diamonds are gray.

12. For all squares x there is a diamond y to the right of x.

Additional Practice Problems:

(listed by section and problem number)

§ 1.2: 5, 6, 11, 7acd
§ 1.3: 3, 5, 7, 11, 19
§ 2.1: 3, 6, 8ad, 12, 14, 21, 25, 27, 34, 36, 41
§ 2.2: 1, 3, 9, 12, 16, 20adf, 22adf, 23adf, 32, 40, 42, 49

§ 2.3: 3, 6, 7, 22, 24, 25, 26, 36
§ 3.1: 2, 5ac, 9, 11, 18abe, 19
§ 3.2: 1, 6a, 9, 11, 13, 16, 20, 26, 30, 37, 41
§ 3.3: 5, 7, 13, 15, 29, 33, 46, 48, 49, 59
§ 3.4: 2, 3, 7, 8, 9, 10