

**Practice Midterm Exam.**

1. Complete the following sentences.
  - (a) An argument with premises  $\phi_1, \dots, \phi_n$  and conclusion  $\psi$  is valid if ...
  - (b) A sentence  $\phi$  is inconsistent if ...
  
2. Short answer: Explain, using words and/or pictures, the  $\vee$ -Elimination rule of inference, including how dependency numbers are tabulated.
  
3. Translate the following English sentences into sentence logic. Use the suggested letters for elementary sentences.
  - (a) Fanny loves Edmund, but Edmund loves Miss Crawford. ( $F, E$ )
  - (b) Fanny loves Mr. Crawford only if he helps her brother. ( $F, H$ )
  - (c) If Fanny loves Mr. Crawford then Edmund is happy, unless Miss Crawford doesn't love him. ( $F, E, M$ )
  
4. Prove the validity of the following arguments. You may use any of the rules of inference that we have learned.
  - (a)
    1.  $\neg P$
    2.  $\neg Q$       /  $\neg (P \vee Q)$
  - (b)
    1.  $(P \rightarrow Q) \vee (P \rightarrow R)$       /  $P \rightarrow (Q \vee R)$
  
5. Prove the following theorem. You may use any of the rules of inference that we have learned.
 
$$// \quad P \leftrightarrow (P \& (Q \vee \neg Q))$$
  
6. Is the the following sentence a tautology, a contradiction, or a contingency? Justify your answer.
 
$$(\neg A \rightarrow A) \rightarrow (B \rightarrow (C \rightarrow (D \rightarrow (E \rightarrow A))))$$
  
7. True or false (justify your answer): There is an inconsistent sentence of the form  $\phi \rightarrow \psi$ , where  $\phi$  is a contingency, and  $\psi$  is an arbitrary sentence.

8. Does sentence (a) imply sentence (b)? Justify your answer.

(a)  $(P \vee Q) \rightarrow (R \vee S)$

(b)  $(P \rightarrow R) \vee (P \rightarrow S)$

9. Is the English sentence connective "...because..." truth-functional? (e.g., "The glass shattered because it was hit with a baseball.") Justify your answer.

10. Suppose that the sentence connective  $\circ$  has the truth table given below:

$P$	$Q$	$P \circ Q$
T	T	F
T	F	F
F	T	F
F	F	F

Find an expression using only  $\&$ ,  $-$ ,  $P$ ,  $Q$  that is equivalent to  $P \circ Q$ .

11. True or False (explain and justify your answer): There could be a correctly written proof with the following line fragments (where  $n$  is some number greater than 1):

- 1    (1)  $(P \rightarrow Q) \rightarrow Q$     A
- ...
- 1    (n)  $-P \rightarrow Q$