SHOW ALL WORK ON THIS TEST OR SEPARATE PAPER. Justify all answers.

In 1 - 3, let U= {a,b,c,d,e,f}, A= {a,b,f}, B= {b,c,d,f}

  1. B′   2. A ∩ B   3. (A ∪ B)′   4. A′∪ B′

In 5 - 7, shade the indicated regions.

  5.   A ∪ B′   6. A ∩ (B ∪ C)   7. (A ∩ B) ∪ C

8. A survey of 260 families showed that
    99 had a dog
    76 had a cat
    34 had a dog and a cat
    30 had a cat and a parakeet
    30 had a dog only
    98 had neither a dog, a cat,
              nor a parakeet
     8 had a cat, a dog, and a parakeet

a) Draw a circle diagram and b) determine how many had a parakeet only?

9 - 12. Give truth tables for

p	q	p∧q	~p∨q	p⟶q	q⟶~p
T	T				
T	F				
F	T				
F	F				

13. State DeMorgan's Laws for either sets or logic:

   a)   b)

 In 14 - 17, give negations for each of the following statements:
14. All students are happy.   15. Some people are lucky.

16. If you win, then you are happy.   17. Nobody likes cats.

18. Express the implication as a disjunction:
    "If you sow the crop, then you will reap the harvest."

19. Express the disjunction as an implication:
    "You must study hard, or you will fail this class."

In 20 - 29, given: "If you use drugs, then you jeopardize your health."

20. Converse:

21. Contrapositive:

22. Inverse:

23. Negation:

24. Which of the above is (are) equivalent to the original statement?

25. Give the sufficient condition.

26. Give the necessary condition.

27. Is "using drugs" sufficient for "jeopardizing your health."

28. Is "using drugs" necessary for "jeopardizing your health."

29. Write the statement using "only if."

In 30-28, use logical principles (name the principle or fallacy!) or Euler circles to determine if the arguments are valid or invalid. Show or explain each answer.

30. If Joe is happy, then he is in love. Joe is not in love. Therefore, he must not be happy.

31. If Joe is happy, then he is in love. Joe is not happy. Therefore, he must not be in love.

32. If Martha is not here, then she must be shopping. Martha is not here. Therefore, she must be shopping.

33. Martha is going to Hunt Club or she is going to Winter Park. She is not going to Hunt Club. Therefore, she is going to Winter Park.

34. I don't like dogs or dogs don't like me. I like dogs. Therefore, dogs don't like me.

35. If Sam drinks too much, then he gets a headache. If he gets a headache, then he can't think straight. Sam can't think straight. Therefore, he drinks too much.

36. If you do the homework, you will learn math. If you learn math, you will pass the test. You did not pass the test. Therefore, you did not do the homework.

37. If you study hard, then you will pass the CLAST. You passed the CLAST. Therefore, you studied hard.
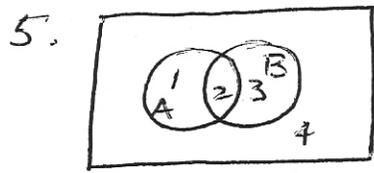
38. All insects have 6 legs. A bee has 6 legs. Therefore, a bee is an insect.

39. All insects have 6 legs. A bee is an insect. Therefore, a bee has 6 legs.

40. All animals have fur. Cats have fur. Therefore, a cat must be an animal.

41. Some dogs chase cars. No cats chase cars. Therefore, no cats are dogs.

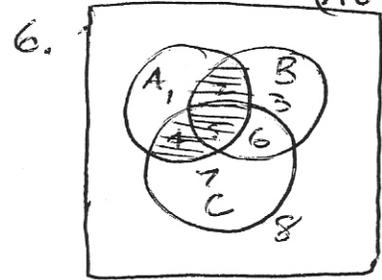In 42 - 44, select the correct answer. (MULTIPLE CHOICE)

42. Select the statement below that is logically equivalent to "If Tom studies, then he will pass CLAST."
   A. Tom studies and does not pass CLAST.
   B. If Tom does not study, then he will not pass CLAST.
   C. If Tom passed CLAST, then he studied.
   D. If Tom did not pass CLAST, then he did not study.

43. Select the rule of logical equivalence that directly (in one step) transforms statement "i" into statement "ii."

   i. If Joe takes calculus, then he will buy a calculator.
   ii. Joe will not take calculus or he will buy a calculator.

   A. "If p, then q" is equivalent to "(not p) or q."
   B. "Not (p and q)" is equivalent to "(not p) or (not q)."
   C. "If p, then q" is equivalent to "if not q, then not p."
   D. Correct equivalence rule is not given.

44. Study the information given below. If a logical conclusion is given, select that conclusion.

   "Mary eats ice cream or she eats yogurt. If Mary eats yogurt, then she is healthy. If Mary is healthy, then she can run the marathon. Mary does not eat yogurt."

   A. Mary does not eat ice cream.
   B. Mary is healthy.
   C. If Mary runs the marathon, then she eats yogurt.
   D. None of the above is warranted.
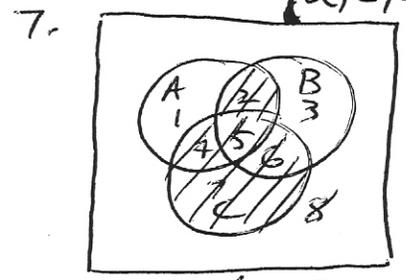
Liberal Arts Math I Logic Exam CR* Solutions.

1. $B' = \{a, e\}$ 2. $A \cap B = \{b, f\}$ 3. $A \cup B = \{a, b, c, d, f\}$ 4. $A' \cup B'$
$(A \cup B)' = \{e\}$ $\{c, d, e\} \cup \{a, e\}$
$\{a, c, d, e\}$

5.
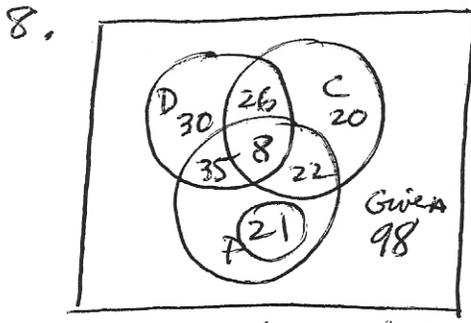
$A = \{1, 2\}$ $B' = \{1, 4\}$
$A \cup B' = \{1, 2, 4\}$

6.

$A = \{1, 2, 4, 5\}$
$B \cup C = \{2, 3, 4, 5, 6, 7\}$
$A \cap (B \cup C) = \{2, 4, 5\}$

7.

$A \cap B = \{2, 5\}$ $C = \{4, 5, 6, 7\}$
$(A \cap B) \cup C = \{2, 4, 5, 6, 7\}$

8.

start in center with 8

34	30	76	260
−8	−8	−56	−239
26	22	20	21

Dog Only = 30   Paraheet Only.
Dog Total = 99 $\begin{array}{r} 30 \\ +26 \\ +8 \\ \hline 64 \end{array}$ 64
$\begin{array}{r} 99 \\ -64 \\ \hline 35 \end{array}$

9-12.

p	q	p∧q	∼p∨q	p→q	q→∼p
T	T	T	F∨T = T	T	T→F = F
T	F	F	F∨F = F	F	F→F = T
F	T	F	T∨T = T	T	T→T = T
F	F	F	T∨F = T	T	F→T = T

13. Sets = $(A \cup B)' = A' \cap B'$ $(A \cap B)' = A' \cup B'$
Logic ∴ $\sim(p \vee q) = \sim p \wedge \sim q$ $\sim(A \wedge q) = \sim p \vee \sim q$

14. Some students are not happy.
15. No people are lucky.
16. You win and you are not happy.
17. Somebody likes cats.
18. $P \rightarrow q$ means $\sim p \vee q$.
You do NOT sow the crop OR you reap harvest.
19. Negating one implies the other.
If you don't study, then you fail.
If you don't fail, then you study.

20. If you jeopardize, then you use drugs.
21. If you don't jeop, then you don't use drugs.
22. If you don't use drugs, then you don't jeopardize health.

23. $\sim(p \rightarrow q) = p \wedge \sim q$.
You use drugs and you do NOT jeop. health.
24. Contrapositive.
25. Using drugs.   26. Jeop. health.
27. Yes   28. No.   29. You use drugs only if you jeop. health.

30. $H \rightarrow L$ 31. $H \rightarrow L$ 32. $\sim H \rightarrow S$
$\dfrac{\sim L}{\therefore \sim H}$ $\dfrac{\sim H}{\therefore \sim L}$ $\dfrac{\sim H}{\therefore S}$
Valid Contrapos.   Fallacy Inverse   Valid Obvious

33. $H \subset V \subset P$ 34. $\sim D \vee \sim M$ 35. $D \rightarrow H$
$\dfrac{\sim H \subset C}{\therefore \sim P}$ $\dfrac{D}{\therefore \sim M}$ $H \rightarrow \sim T$
Valid Disjunct.   Valid Disj. $\dfrac{\sim T}{\therefore D}$
Fallacy of converse

36. $H \rightarrow M$ 37. $S \rightarrow C$
$M \rightarrow P$ $\dfrac{C}{\therefore S}$
$\dfrac{\sim P}{\therefore \sim H}$
Valid Transitive   Fallacy
and Contrapos.   Converse.

38.

Invalid

39.

Valid

40.

Invalid

41.

42. D Contrapositive.

43. A.   44. D