FINITE MATH   LOGIC EXAM B   NAME _____
SHOW ALL WORK ON THIS TEST OR SEPARATE PAPER.   Justify all answers.

In 1 - 2 state DeMorgan's Laws:

1.   2.

In 3 - 6, give negations for each of the following statements:
3. Some students are happy.   4.   If you pass, then you are lucky..

5.   You win the game or you are sad.   6.   All dogs chase cats.

7.   Express the implication as a disjunction:
     "If you take Finite Math, then you will pass the CLAST."

8.   Express the disjunction as an implication:
     "You take Finite Math, or you will not pass the CLAST."

In 9-18, given: "If you run too slow, then you will not win the race."

9.   Inverse:

10. Converse:

11. Contrapositive:

12. Negation:

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

14. Give the sufficient condition:

15. Give the necessary condition:

16. Is "winning the race" sufficient "running fast enough"?

17. Is "winning the race" necessary to "running fast enough"?

18. Write the statement using "only if."

19. Given: "I will be sorry if you do not study."
     Give the contrapositive.

20. Given: "I will be sorry if you do not study."
     Give the converse.

In 21-28, 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.

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

22. If Joe is happy, then he is in love. Joe is in love. Therefore, he must be happy.

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

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

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

26. I like dogs or I like cats. I like cats. Therefore, I do not like dogs.

27. If you take Finite Math, you will learn logic. If you learn logic, you will pass the CLAST. You did not pass the CLAST. Therefore, you did not take Finite Math.

28. 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.

29. Sam has a headache today. I know this because if he drinks too much, then he gets a headache, and Sam does drink too much.

30. If you study hard, then you will pass the CLAST. You passed the CLAST. Therefore, you studied hard.

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

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

33. Some animals have fur. Cats have fur. Therefore, a cat must be an animal.

34. No birds have fur. Cats have fur. Therefore, no cats are birds.

35. All swimmers wear suim suits. All beachcombers are swimmers. Jane is a beachcomber. Therefore, Jane wears a suim suit.

36. Some bad men are successful. Some successful men work hard. Therefore, some bad men work hard.

In 37-44, select the correct answer (MULTIPLE CHOICE):

37. Select the statement that is the negation of the statement "If it rains, we will not go to the store."
    A. If it doesn't rain, then we will go to the store.
    B. It is raining and we do not go to the store.
    C. If we go to the store, then it will not rain.
    D. It is raining and we will go to the store.

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

39. Given that: i. No people who assign work are lovable.
                ii. All supervisors assign work.
    determine which conclusion can be logically deduced.
    A. All supervisors are lovable.
    B. Some supervisors are lovable.
    C. No supervisors are lovable.
    D. None of the above is true.

40. Select the conclusion that will make the following argument valid.
"If I pass the CLAST, then I will get my AA degree. If I get
my AA degree, then I will attend the university."
A.   If I do not pass the CLAST, then I will not attend the
university.
B.   If I get my AA degree, then I pass the CLAST.
C.   If I pass the CLAST, then I will attend the university.
D.   If I pass the CLAST, then I will not attend the university.

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

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

i.   If x^2 is even, then x is even.
ii.   If x is not even, then x^2 is not even.

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

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

"If I pass this test, then I will graduate. I pass this test or
I get a job. I did not get a job."
A. I did not pass this test.
B. I did not graduate.
C. I did graduate.
D. None of the above is warranted.

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.

FINITE MATH LOGIC FORM B Solutions.

1. $\sim(p \lor q) = \sim p \land \sim q$
2. $\sim(p \land q) = \sim p \lor \sim q$.
3. No Students are happy.
4. $\sim(p \to q) = p \land \sim q$
   You pass and not lucky.
5. You do not win and
   You are not sad.
6. Some dogs do not chase cats.
7. $p \to q = \sim p \lor q$
   You do not take Finite or
   You pass CLAST.
8. $p \lor q =$ Negate one, imply other.
   If no Finite, then no pass CLAST
   or If pass CLAST, then take Finite.
9. If not too slow, then win race.
10. If not win race, then run too slow.
11. If win race, then not too slow.
12. $\sim(p \to q) = p \land \sim q$
    Run too slow and win race.
13. Contrapositive
14. Run too slow   15. Not win race
16. No   17. Yes
18. You run too slow only if you do not win
    or Only if you do not win, did you run too slow.

Rephrase: If you do not study, then I will be sorry.
19. Contrapos = If I am not sorry, then you studied.
20. Converse: If I am sorry, then you did not study.

21. Joe happy $\to$ Love
    $\sim$ Happy
    $\therefore \sim$ Love.
    (Fallacy of Inverse)

22. $H \to L$
    L
    $\therefore H$
    (Fallacy of Converse)

23. Not here $\to$ shop
    $\sim$ shop
    $\therefore$ Is here
    (Valid Contrapos)

24. H.C. $\lor$ W.P.
    WP
    $\therefore \sim$ H.C.
    (Fallacy of disj.)

25. $\sim$ Like dogs $\lor \sim$ Like me
    Like dogs
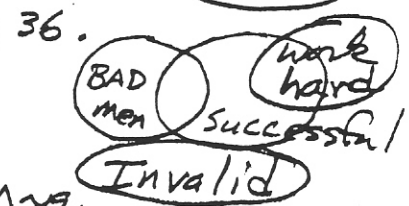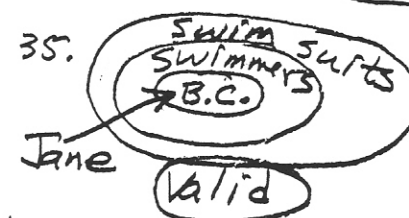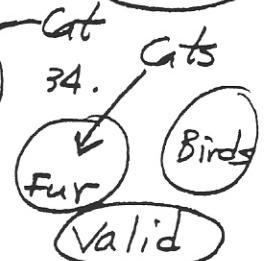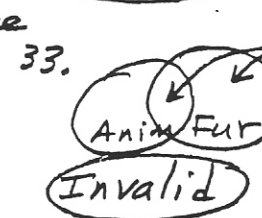 $\therefore \sim$ Like me
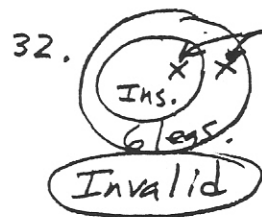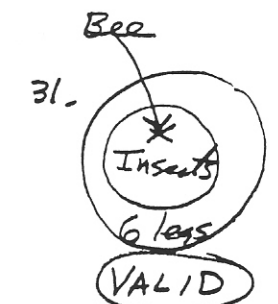   (Valid by disjunction)

26. $D \lor C$
    C
    $\therefore \sim D$
    (Fall of disj)

27. F.M. $\to$ L.L.
    L.L. $\to$ P.C.
    $\sim$ P.C.
    $\therefore \sim$ L.L.
    $\sim$ F.M.
    (Valid by Transitive and Contrapositive)

28. $D \to H$
    $H \to \sim T.S.$
    $\sim T.S.$
    $\therefore D$
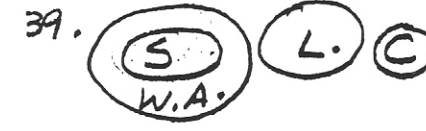   (Fallacy of Converse)

29. $D \to H$
    D
    $\therefore H$
    (Valid Obvious Law)

30. S.H. $\to$ P.C.
    P.C.
    $\therefore$ S.H.
    (Fallacy of Converse)

31. (Venn diagram: Insects, 6 legs, Bee ✗)
    VALID

32. (Venn diagram: Ins., 6 legs, Bee ✗✗)
    Invalid

33. (Venn diagram: Anim, Fur, Cat)
    Invalid

34. (Venn diagram: Cats, Fur, Birds)
    Valid

35. (Venn diagram: Swimmers, Swim suits, B.C., Jane)
    Valid

36. (Venn diagram: BAD men, work hard, successful)
    Invalid

37. $\sim(p \to q) = p \land \sim q$ ⓓ

38. Contrapositive ©

39. (diagram: S W.A., L, C)

40. CL $\to$ AA
    AA $\to$ Univ
    $\therefore$ CL $\to$ Univ
    Transitive
    ©

41. i) $p \to q$
    ii) $\sim p \lor q$. Ⓑ

42. i) $p \to q$
    ii) $\sim q \to \sim p$ Ⓑ

43. $p \to$ grad.
    $p \lor$ job
    $\sim$ job
    $\therefore$ P; $p \to$ grad.
    ©

44. I.C. $\lor$ Y
    Y $\to$ H
    H $\to$ Run
    $\sim$ Y
    $\therefore$ I.C.
    ⓓ