Exam 2 will be on 03/03/11 and cover the following sections: 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7.

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Decide whether the following is a statement or is not a statement.
1) Not all flowers are roses.
2) This test is too hard.
3) \(0.6 = 0.6\)
4) \(\sqrt{2}\) is an ugly number.

Write a negation for the statement.
5) Charlie plays football.
6) That athlete wants to be a musician.
7) \(x \leq 13\)
8) \(x > 93\)
9) \(x \geq -17\)

Let \(p\) represent the statement "Jim plays football" and let \(q\) represent the statement "Michael plays basketball." Convert the compound statement into symbols.
10) Jim does not play football and Michael plays basketball.
11) Jim does not play football or Michael plays basketball.
12) It is not the case that Jim does not play football and Michael does not play basketball.
13) Jim does not play football or Michael does not play basketball.
14) Jim plays football and Michael plays basketball.

Translate the symbolic compound statement into words.
15) Let \(p\) represent the statement "Her name is Lisa" and let \(q\) represent the statement "She lives in Chicago."
\(p \lor \neg q\)

16) Let \(p\) represent the statement "Students are males" and let \(q\) represent the statement "Teachers are males."
\(\neg (p \lor \neg q)\)
17) Let \( p \) represent the statement "Jello is tasty" and let \( q \) represent the statement "Thursday is rectangular."

\[ \sim p \land \sim q \]

Write a negation of the statement.
18) No fifth graders play soccer.

19) Some athletes are musicians.

Write the compound statement in symbols.
Let \( r = "The food is good," \) \( p = "I eat too much," \) \( q = "I'll exercise." \)

20) If I exercise, then I won't eat too much.

21) If the food is good or if I eat too much, I'll exercise.

22) The food is good and if I eat too much, then I'll exercise.

23) I'll exercise if I don't eat too much.

24) If I exercise, then the food won't be good and I won't eat too much.

Write the compound statement in words.
Let \( r = "The puppy is trained," \) \( p = "The puppy behaves well," \) \( q = "His owners are happy." \)

25) \( p \rightarrow r \)

26) \( r \land (p \rightarrow q) \)

27) \( \sim r \rightarrow \sim q \)

28) \( (r \land p) \rightarrow q \)

Select letters to represent the simple statements and write each statement symbolically by using parentheses then indicate whether the statement is a negation, conjunction, disjunction, conditional, or biconditional.
29) If tomorrow is not Saturday then today is Friday if and only if tomorrow is Saturday.

30) If a number is divisible by 3 and the number is not divisible by 2 then the number is not divisible by 6.

31) The lights are on if and only if it is not midnight or it is wintertime.

32) It is not true that if you take your vitamins you will stay healthy.

33) If people drive small cars then people will use less fuel and the ozone hole will not expand.
Construct a truth table for the compound statement.

34) \( r \lor \neg(s \land c) \)

35) \( (p \land \neg t) \land q \)

36) \( p \lor (p \land \neg p) \)

37) \( \neg(s \lor t) \land \neg(t \land s) \)

38) \( \neg[-(q \lor s)] \)

39) \( (p \land s) \land (\neg s \lor t) \)

Construct a truth table for the statement.

40) \( \neg p \rightarrow (\neg p \land t) \)

41) \( (q \rightarrow \neg p) \rightarrow (q \land \neg p) \)

42) \( (p \rightarrow q) \rightarrow (\neg p \lor q) \)

43) \( \neg(p \rightarrow q) \rightarrow (p \land \neg q) \)

44) \( (\neg p \lor \neg q) \rightarrow \neg(q \land p) \)

Construct a truth table for the statement.

45) \( (p \rightarrow q) \rightarrow (\neg p \lor q) \)

46) \( (\neg p \rightarrow q) \leftrightarrow (q \rightarrow \neg r) \)

47) \( (\neg p \lor \neg q) \rightarrow \neg(q \land p) \)

Use DeMorgan’s laws or a truth table to determine whether the two statements are equivalent.

48) \( \neg(p \land q), \neg p \lor q \)

49) \( p \lor q, \neg(-p \land \neg q) \)

50) \( \neg(-p \rightarrow q), p \lor \neg q \)

51) \( \neg(p \lor q) \rightarrow r, (\neg p \land \neg q) \rightarrow r \)

52) \( (p \lor q) \lor r, p \lor (q \lor r) \)

53) \( p \leftrightarrow (q \lor r), \neg p \rightarrow (q \land r) \)

54) \( (p \rightarrow q) \lor (q \rightarrow p), (p \leftrightarrow q) \)
55) \((q \rightarrow p) \land (p \rightarrow q), (q \leftrightarrow p)\)

For the given direct statement, write the indicated related statement (converse, inverse, or contrapositive).
56) If I pass, then I'll party. (contrapositive)

57) If you like me, then I like you. (converse)

Use DeMorgan's laws if necessary.
58) If the moon is out, then we will start a campfire and we will roast marshmallows.
   Inverse

Write the converse, inverse, and contrapositive of the given statement.
59) If you have 30 years of teaching experience, then you get your full retirement.

60) If your IQ is between 90 and 110, you are of average intelligence.

Use DeMorgan's laws if necessary.
61) If the chores are done, then we will go to the carnival and we will eat cotton candy.
   Contrapositive

62) If the moon is out, then we will start a campfire and we will roast marshmallows.
   Inverse

63) If you like me, then I like you.
   Converse

64) If \(x = 9\), then \(x^2 = 81\).
   Converse

Write an equivalent sentence for the statement.
65) It is false that cats are lazy or dogs are not friendly. (Hint: Use De Morgan's laws.)

66) Denim is not out and linen is not in. (Hint: Use De Morgan's laws.)

67) You do not give your coat to the doorman or he will give you a dirty look. (Hint: Use the fact that \(p \rightarrow q\) is equivalent to \(\sim p \lor q\).

68) If you can't take the heat, stay out of the kitchen. (Hint: Use the fact that \(p \rightarrow q\) is equivalent to \(\sim p \lor q\).

69) If it is raining, you take your hat. (Hint: Use the fact that \(p \rightarrow q\) is equivalent to \(\sim p \lor q\).

70) If you are strong then you are dynamic, and if you are dynamic then you are strong. (Hint: Use the fact that \((p \rightarrow q) \land (q \rightarrow q)\) is equivalent to \(p \leftrightarrow q\).)

71) An number \(n\) is divisible by 3 if and only if the sum of the digits of \(n\) is divisible by 3.
   (Hint: Use the fact that \((p \rightarrow q) \land (q \rightarrow q)\) is equivalent to \(p \leftrightarrow q\).)
Write the negation of the statement. Remember that the negation of \( p \rightarrow q \) is \( p \land \neg q \).

72) If it is raining, you take your umbrella.  
72) ____________

73) If \( c - 4 \leq 3 \), then \( c \leq 7 \).  
73) ____________

74) If \( 7x + 2y > 12 \), the answer is "Earth".  
74) ____________

75) If the package is in the mail, then it will be here by Thursday.  
75) ____________

76) If the staple gun is on the floor, the baby will get hurt.  
76) ____________

Write the statement as an equivalent statement that does not use the if . . . then connective. Remember that \( p \rightarrow q \) is equivalent to \( \neg p \lor q \).

77) If you can’t win the match, then you don’t bother playing.  
77) ____________

78) If your vest needs cleaning, you drop it off this afternoon.  
78) ____________

79) If you can’t find the right dress for the party, then you make one yourself.  
79) ____________

80) If Sara does not want to go, then she stays home.  
80) ____________

Use one of De Morgan’s laws to write the negation of the statement.

81) \( 8 + 3 = 11 \) and \( 9 - 3 \neq 6 \)  
81) ____________

82) Denim is out and linen is in.  
82) ____________

83) Roger or Emil will attend the game.  
83) ____________

84) The Tigers will win their sectional match or the Wolverines will win by default.  
84) ____________

85) The captain of the chess team is handsome and smart.  
85) ____________

86) I was a day late and a dollar short.  
86) ____________

Determine whether the argument is valid or invalid.

87) Michael Bolton is a hunk or Madonna cannot sing. If Madonna cannot sing, then Cigar does not win the Triple Crown. Cigar wins the Triple Crown. Therefore, Michael Bolton is not a hunk.  
87) ____________

88) If Ann so wishes, then Bill will be the president. Manuel is a public defender or Bill will be the president. Manuel is not a public defender. Therefore, Ann does not so wish.  
88) ____________

89) The Rams will be in the playoffs if and only if Ozzie is an all-star. Mark loves the Rams or Ozzie is an all-star. Mark does not love the Rams. Therefore, the Rams will not be in the playoffs.  
89) ____________
90) If I were your friend and you were my soul mate, then I’d never stop liking you. I’ve stopped liking you. Therefore, I was not your friend or you were not my soul mate.

91) If Cathy is a gambler, then she lives in Marine. If Cathy lives in Marine, then she loves horses. Therefore, if Cathy does not love horses, then she is not a gambler.

92) If I hear that poem, then I am reminded of my mother. If I get sentimental, then I am not reminded of my mother. I get sentimental. Therefore, I don’t hear that poem.

93) Loretta’s hobby is stamp collecting. If her husband likes to fish, then Loretta’s hobby is not stamp collecting. If her husband does not like to fish, then Nathan likes to read. Therefore, Nathan likes to read.

Decide whether the argument is valid or invalid, and give the form (of valid or invalid argument) that applies.

94) If it’s Tuesday, then this must be Paris. Today is Wednesday. This must not be Paris.

95) You get soup or you get salad. You did not get soup. You got salad.

96) If the bell rings, then we answer the door. The bell rings. We answer the door.

97) If it is cold, then you need a coat. You do not need a coat. It is not cold.

98) If you read, then you will have a high score. You do not read. You will not have a high score.

99) If the bough breaks, then the cradle will fall. The bough breaks. The cradle will fall.

100) If you wear a tie, then you look natty. You do not look natty. You are not wearing a tie.

Determine if the argument is valid.

101) All businesses are subject to safety inspections. This restaurant is subject to safety inspections. This restaurant is a business.
102) Some investments are risky.  
Real estate is an investment.  
Real estate is risky.
103) All businessmen wear suits.  
Aaron wears a suit.  
Aaron is a businessman.
104) No even number is divisible by 9.  
54 is an even number.  
54 is not divisible by 9.
105) All students who study get better grades.  
Roger is a student who studies.  
Roger gets better grades.

The argument has a true conclusion. Identify the argument as valid or invalid.
106) All dogs have fur.  
All cats have fur.  
A cat is not a dog.
107) All soda pops are carbonated.  
All diet colas are soda pops.  
All diet colas are carbonated.
108) Rational numbers are real numbers.  
Integers are rational numbers.  
Integers are real numbers.
1) Statement
2) Not a statement
3) Statement
4) Not a statement
5) Charlie does not play football.
6) That athlete does not want to be a musician.
7) $x > 13$
8) $x \leq 93$
9) $x < -17$
10) $\neg p \land q$
11) $\neg p \lor q$
12) $\neg (\neg p \land \neg q)$
13) $\neg p \lor \neg q$
14) $p \land q$
15) Her name is Lisa or she does not live in Chicago.
16) It is not the case that students are males or teachers are not males.
17) Jello is not tasty and Thursday is not rectangular.
18) Some fifth graders play soccer.
19) No athletes are musicians.
20) $q \rightarrow \neg p$
21) $(r \lor p) \rightarrow q$
22) $r \land (p \rightarrow q)$
23) $\neg p \rightarrow q$
24) $q \rightarrow (\neg r \land \neg p)$
25) If the puppy behaves well then the puppy is trained.
26) The puppy is trained, and if the puppy behaves well then his owners are happy.
27) If the puppy is not trained then his owners are not happy.
28) If the puppy is trained and the puppy behaves well, then his owners are happy.
29) $(\neg p \rightarrow q) \iff p$; biconditional
30) $(p \land \neg q) \rightarrow (\neg r)$; conditional
31) $p \iff (\neg q \lor r)$; biconditional
32) $(\neg r \lor q)$; negation
33) $p \rightarrow (q \land \neg r)$; conditional
34)

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### 35) \( p \land \neg t \land q \)

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### 36) \( p \lor (p \land \neg p) \)

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### 37) \( \neg (s \lor t) \land \neg (t \land s) \)

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### 38) \( \neg (q \lor s) \)

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### 39) \( (p \land s) \land \neg (s \lor t) \)

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### 40) \( \neg p \rightarrow \neg (p \land t) \)

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### 41) \( (q \rightarrow \neg p) \rightarrow (q \land \neg p) \)

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Answer Key

Testname: MGF_1106_SPRING_11_EXAM_2_REVIEW

42) \( p \quad q \quad (p \rightarrow q) \rightarrow (\neg p \lor q) \)

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43) \( p \quad q \quad \neg(p \rightarrow q) \rightarrow (p \land \neg q) \)

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44) \( p \quad q \quad (\neg p \lor \neg q) \rightarrow \neg(q \land p) \)

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45) \( p \quad q \quad (p \rightarrow q) \rightarrow (\neg p \lor q) \)

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46) \( p \quad q \quad r \quad (\neg p \lor q) \leftrightarrow (q \rightarrow \neg r) \)

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47) \( p \quad q \quad (\neg p \lor \neg q) \rightarrow \neg(q \land p) \)

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48) Not equivalent
49) Equivalent
50) Not equivalent
51) Equivalent
52) Equivalent
53) Not equivalent
54) Not equivalent
55) Equivalent
56) If I don’t party, then I didn’t pass.
57) If I like you, then you like me.
58) If the moon is not out, then we will not start a campfire or we will not roast marshmallows.
59) Converse: If you get your full retirement, then you have 30 years of teaching experience. Inverse: If you do not have 30 years of teaching experience, then you do not get your full retirement. Contrapositive: If you do not get your full retirement, then you do not have 30 years of teaching experience.

60) Converse: If you are of average intelligence, then your IQ is between 90 and 110. Inverse: If your IQ is not between 90 and 110, then you are not of average intelligence. Contrapositive: If you are not of average intelligence, then your IQ is not between 90 and 110.

61) If we do not go to the carnival or we do not eat cotton candy, then the chores are not done.

62) If the moon is not out, then we will not start a campfire or we will not roast marshmallows.

63) If I like you, then you like me.

64) If $x^2 = 81$, then $x = 9$.

65) Cats are not lazy and dogs are friendly.

66) It is not the case that denim is out or linen is in.

67) You give your coat to the doorman and he will give you a dirty look.

68) You can take the heat or stay out of the kitchen.

69) It is not raining or you take your hat.

70) You are strong if and only if you are dynamic.

71) If a number $n$ is divisible by 3 then the sum of the digits of $n$ is divisible by 3, and if the sum of the digits of $n$ is divisible by 3 then the number $n$ is divisible by 3.

72) It is raining and you do not take your umbrella.

73) $c - 4 \leq 3$ and $c > 7$.

74) $7x + 2y > 12$ and the answer is not "Earth".

75) The package is in the mail and it will not be here by Thursday.

76) The staple gun is on the floor and the baby does not get hurt.

77) You can win the match or you don’t bother playing.

78) Your vest does not need cleaning or you drop it off this afternoon.

79) You can find the right dress for the party or you make one yourself.

80) Sara wants to go or she stays home.

81) $8 + 3 \neq 11$ or $9 - 3 = 6$.

82) Denim is not out or linen is not in.

83) Roger will not attend the game and Emil will not attend the game.

84) The Tigers will not win their sectional match and the Wolverines will not win by default.

85) The captain of the chess team is not handsome or not smart.

86) I was not a day late or not a dollar short.

87) Invalid

88) Invalid

89) Invalid

90) Valid

91) Valid

92) Valid

93) Valid

94) Invalid; fallacy of the inverse

95) Valid; disjunctive syllogism

96) Valid; modus ponens

97) Valid; modus tollens

98) Invalid; fallacy of the inverse

99) Valid; modus ponens

100) Valid; modus tollens

101) Invalid

102) Invalid

103) Invalid

104) Valid
Answer Key
Testname: MGF_1106_SPRING_11_EXAM_2_REVIEW

105) Valid
106) Invalid
107) Valid
108) Valid