3. What is the negation of each of these propositions?

a) Linda is younger than Sanjay.
b) Mei makes more money than Isabella.
c) Moshe is taller than Monica.
d) Abby is richer than Ricardo.

5. What is the negation of each of these propositions?

a) Mei has an MP3 player.
b) There is no pollution in New Jersey.
c) $2 + 1 = 3$.
d) The summer in Maine is hot and sunny.

13. Let p and q be the propositions

p: It is below freezing.
q: It is snowing.

Write these propositions using p and q and logical connectives (including negations).

a) It is below freezing and snowing.
b) It is below freezing but not snowing.
c) It is not below freezing and it is not snowing.
d) It is either snowing or below freezing (or both).
e) If it is below freezing, it is also snowing.
f) Either it is below freezing or it is snowing, but it is not snowing if it is below freezing.
g) That it is below freezing is necessary and sufficient for it to be snowing.

19. Determine whether each of these conditional statements is true or false.

a) If $1 + 1 = 2$, then $2 + 2 = 5$.
b) If $1 + 1 = 3$, then $2 + 2 = 4$.
c) If $1 + 1 = 3$, then $2 + 2 = 5$.
d) If monkeys can fly, then $1 + 1 = 3$.

21. For each of these sentences, determine whether an inclusive or, or an exclusive or, is intended. Explain your answer.

a) Coffee or tea comes with dinner.
b) A password must have at least three digits or be at least eight characters long.
c) The prerequisite for the course is a course in number theory or a course in cryptography.
d) You can pay using U.S. dollars or euros.

25. Write each of these statements in the form "if p, then q" in English. [*Hint:* Refer to the list of common ways to express conditional statements.]

a) It snows whenever the wind blows from the northeast.
b) The apple trees will bloom if it stays warm for a week.
c) That the Pistons win the championship implies that they beat the Lakers.
d) It is necessary to walk eight miles to get to the top of Long's Peak.
e) To get tenure as a professor, it is sufficient to be world famous.
f) If you drive more than 400 miles, you will need to buy gasoline.
g) Your guarantee is good only if you bought your CD player less than 90 days ago.
h) Jan will go swimming unless the water is too cold.
i) We will have a future, provided that people believe in science.

35. Construct a truth table for each of these compound propositions.

a) $(p \vee q) \rightarrow (p \oplus q)$
b) $(p \oplus q) \rightarrow (p \wedge q)$
c) $(p \vee q) \oplus (p \wedge q)$
d) $(p \leftrightarrow q) \oplus (\neg p \leftrightarrow q)$
e) $(p \leftrightarrow q) \oplus (\neg p \leftrightarrow \neg r)$
f) $(p \oplus q) \rightarrow (p \oplus \neg q)$

Truth Table to Compound Propositions (not in textbook)

For each unknown proposition, x, y, and z:

- Find an expression for the proposition as a compound proposition using x, y, and z.
- You may use **only** $\wedge$, $\vee$, $\neg$, and parentheses in each expression.
- You may use x, y, and z **at most once** in each expression.

p	q	r	x	y	z
T	T	T	F	T	T
T	T	F	F	T	F
T	F	T	F	T	T
T	F	F	F	F	F
F	T	T	F	T	T
F	T	F	F	T	F
F	F	T	T	T	T
F	F	F	T	T	T