Discrete Structures (W1): Quiz

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Question 1. Fill in the missing entries in the truth table of this proposition:

$$E = \neg(r \to \neg q) \wedge (q \to r).$$

Fill in the . . .:

p	q	r	E
T	T	T	don't care
T	T	F	don't care
T	F	T	. . .
T	F	F	. . .
F	T	T	don't care
F	T	F	don't care
F	F	T	. . .
F	F	F	. . .

Question 2. Find the Boolean expression that has this truth table:

p	q	?
T	T	F
T	F	F
F	T	T
F	F	F

(Select 1 answer):

(A) $\neg(p \to q)$,
(B) $\neg p \to \neg q$,
(C) $\neg(q \to p)$,
(D) $\neg q \to \neg p$.

Question 3. Determine whether the following proposition is *satisfiable*: $(\neg p \vee \neg q) \wedge (p \to q)$. If it is satisfiable, what are the truth values for p and q that makes it `true`.

(Circle answer and fill in the . . ., if appropriate.)
Is the expression satisfiable: YES NO
If yes, what values can satisfy it (just 1 example):
$p = \ldots$ $q = \ldots$ $r = \ldots$.

Question 4. Consider the following proposition: "You cannot eat vegetables unless you also eat ice cream." Express it as a Boolean expression, if there are two atomic propositions:
A: "Person x can eat vegetables."
B: "Person x eats ice cream."

(Write your expression here) . . .

Question 5. Determine whether the following two propositions are logically equivalent: $E_1 = p \vee \neg(q \vee r)$ and $E_2 = (p \wedge \neg q) \vee (p \wedge \neg r)$.
If they are not equivalent, find some values p, q, r that makes E_1 different from E_2.

(Circle answer and fill in the . . ., if appropriate.)
Are both expressions equivalent: YES NO
If not, which truth values make them different:
$p = \ldots$ $q = \ldots$ $r = \ldots$.

Question 6. Translate the given statement into propositional logic using the propositions provided:

> "In Riga a person can receive *low income status*, if he or she lives in a family where the income per family member during the last 3 months did not exceed 320 EUR per month, or there is one person in your family, who receives an old-age or disability benefit up to 400 EUR per month."

Express your answer in terms of 3 atomic propositions
A: "You are living in a family where the average income per family member does not exceed 320 EUR per month during the last 3 months."
B: "You are a single who receives an old-age or disability benefit not exceeding 400 EUR per month." and
C: "You can get low income status."

(Write your expression here) . . .

Question 7. (*Note:* In this problem "knights" always tell the truth and "knaves" always lie.)
Person A says "B is a knave." Person B says "We are both knights." Determine whether each person is a knight or a knave.

Is this situation possible: YES NO
If the situation is possible, who are A, B: . . .