Q1 Which of the following is an interpretation of $((\neg P \Rightarrow Q) \wedge R)$ that makes the sentence true?

- a) P = 1, Q = 0, R = 0
- b) P = 0, Q = 0, R = 1
- c) P = 1, Q = 1, R = 0
- d) P = 1, Q = 1, R = 1

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Solution

- Plugging in P = 1, Q = 1, R = 1, we have $((\neg 1 \Rightarrow 1) \wedge 1)$ which is equivalent to $(\neg 1 \Rightarrow 1)$ since $(x \wedge 1 = x)$. Then, $(\neg 1 \Rightarrow 1)$ is equivalent to $(0 \Rightarrow 1)$. We then note that implication is always true when the premise (here $\neg$ P) is false. Thus, the overall sentence is TRUE or 1.

Q2. Let KB = {A, B} be a knowledge base. Which sentences does KB entail?

- a) A OR NOT B
- b) NOT B
- c) NOT A
- d) NOT A AND NOT B
- e) both a and c

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Solution

- Note A is in the KB and so is entailed. Also, A implies A OR C for any other sentence C. Thus plugging in C = (NOT B), we have A implies A OR NOT B, and so the KB entails this sentence.

Q3. Which of the following sentences represents $(P \Rightarrow (Q \Rightarrow R))$ in CNF?

- a) P OR (Q AND R)
- b) P AND Q OR NOT R
- c) NOT P OR (NOT Q OR R)
- d) P OR Q OR (R AND NOT Q)

Q3. Which of the following sentences represents $(P \Rightarrow (Q \Rightarrow R))$ in CNF?

- a) P OR (Q AND R)
- b) P AND Q OR NOT R
- c) NOT P OR (NOT Q OR R)
- d) P OR Q OR (R AND NOT Q)

Solution

- We need to get rid of the IMPLIES by converting them into AND, OR, and, NOT statements. Recall, P $\Rightarrow$ B is logically equivalent to NOT P OR B. Similarly, Q $\Rightarrow$ R is equivalent to NOT Q OR R. Thus, setting B = NOT Q OR R, we have in total NOT P OR (NOT Q OR R) is an equivalent sentence made with only ORs of variables or negations of variables. Thus, it is in CNF (note we did not need ANDs in this case).