CENG 424

LOGIC FOR COMPUTER SCIENCE

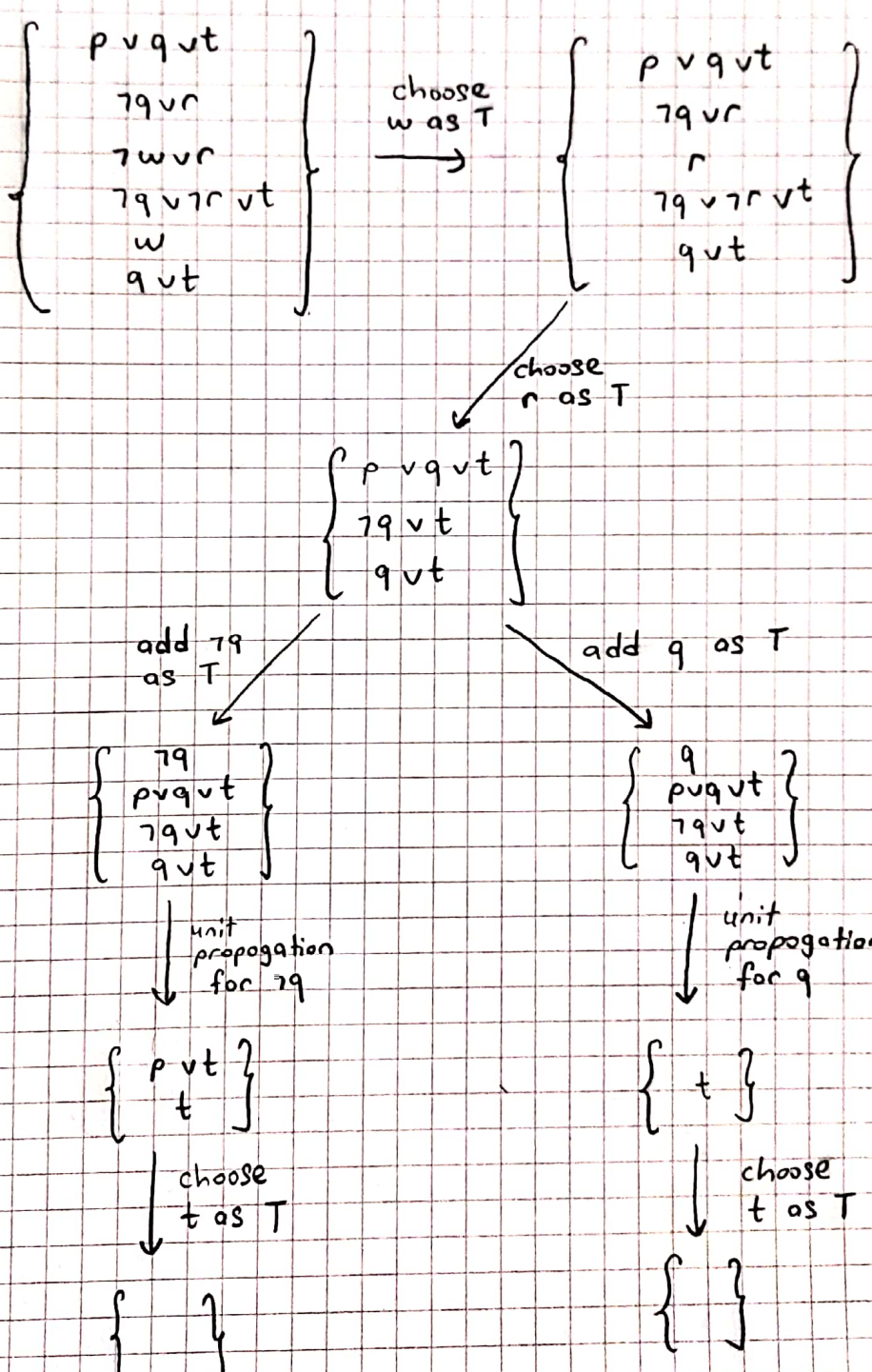
Assignment 2

Name: Orgun BASSIMSEK

ID: 2098804

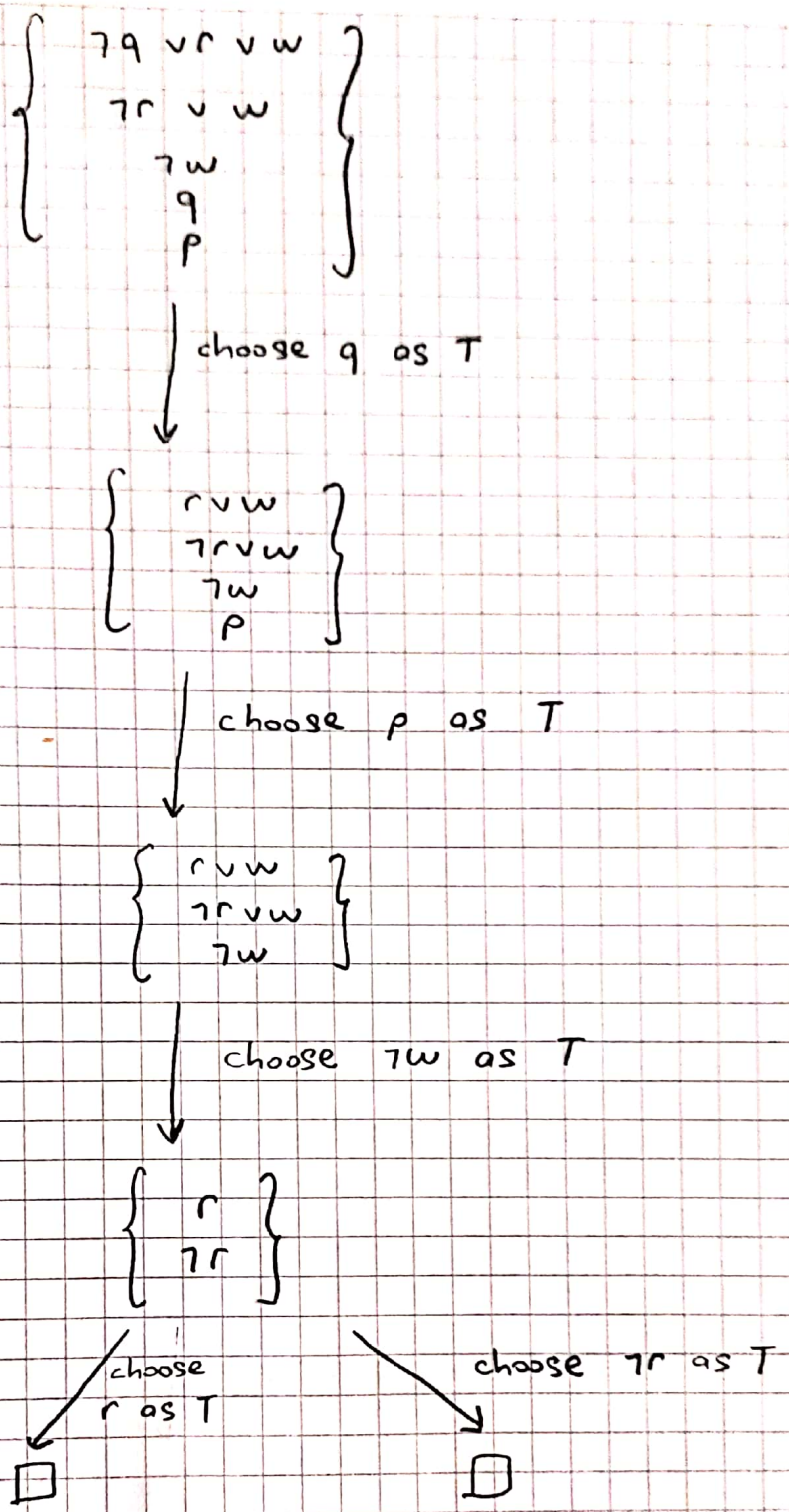
Question 1-)

1.



RESULT: Since we reach empty set for all branches, this formula is SATISFIABLE.

2.



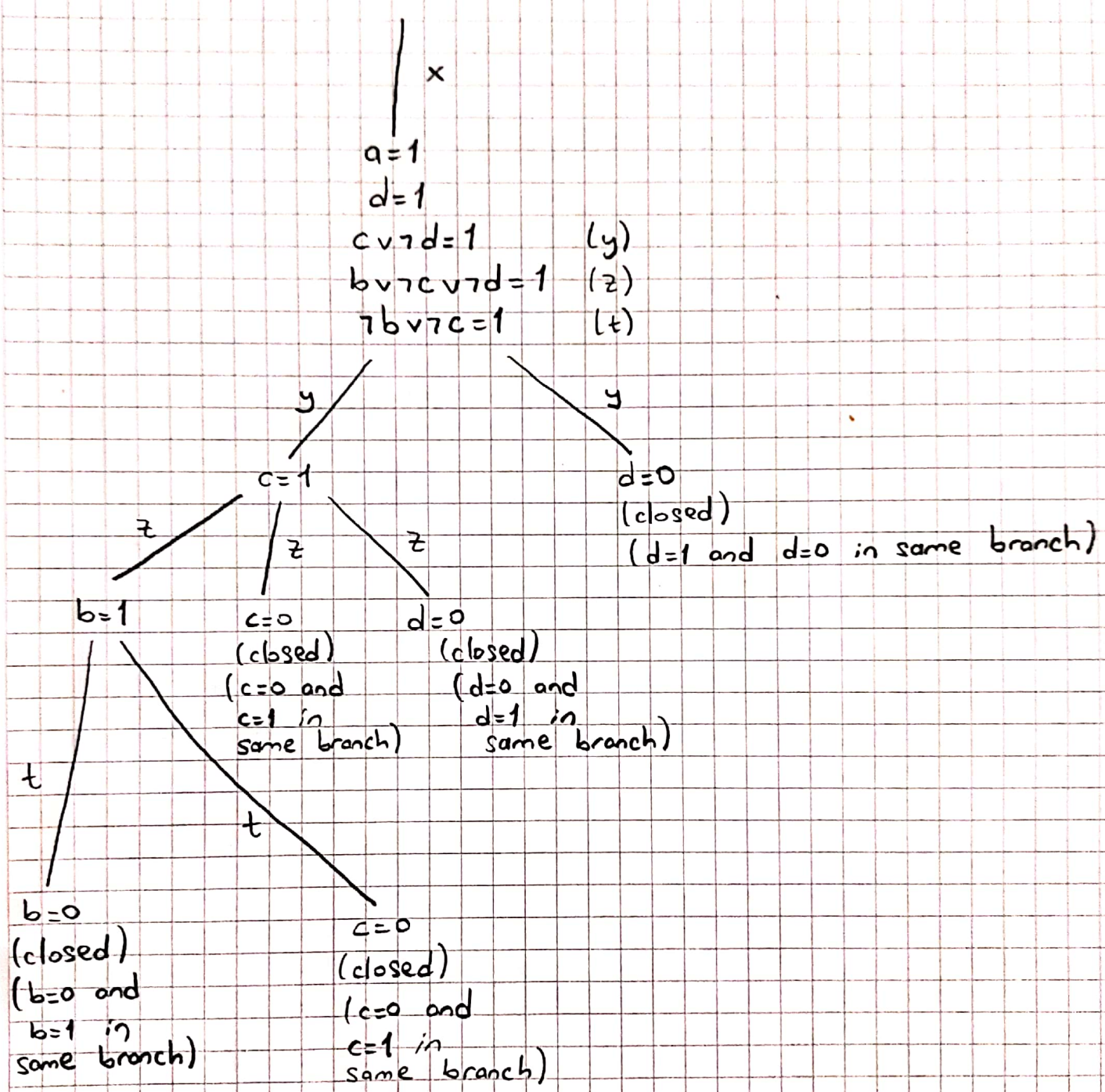
RESULT: We know that these clouses ANDed at the end. When we look $r \wedge \neg r$, this is a contradiction.

Thus, result is $\square$.

This formula is UNSATISFIABLE.

Question 2-)

1. $a \wedge d \wedge (c \vee \neg d) \wedge (b \vee \neg c \vee \neg d) \wedge (\neg b \vee \neg c) = 1$ (x)



RESULT: Since every branch is closed,

this formula is UNSATISFIABLE.

2. These two formulas are equivalent if and only if when $(p \Rightarrow (q \vee r)) \leftrightarrow ((s \wedge q) \Rightarrow ((p \wedge s) \Rightarrow r)) = 0$, all branches are closed.

$$(p \Rightarrow (q \vee r)) \leftrightarrow ((s \wedge q) \Rightarrow ((p \wedge s) \Rightarrow r)) = 0 \quad (a)$$

a

$p \Rightarrow (q \vee r) = 1$ (b)

$(s \wedge q) \Rightarrow ((p \wedge s) \Rightarrow r) = 0$ (c)

b

$p = 0$

c

$s \wedge q = 1$ (e)

$((p \wedge s) \Rightarrow r) = 0$ (f)

e

$s = 1$

$q = 1$

f

$p \wedge s = 1$ (g)

$r = 0$

g

$p = 1$

$s = 1$

(closed)

($p = 0$ and $p = 1$ in same branch)

b

$q \vee r = 1$ (d)

c

$s \wedge q = 1$ (h)

$((p \wedge s) \Rightarrow r) = 0$ (j)

d

$q = 1$

h

$s = 1$

$q = 1$

j

$p \wedge s = 1$ (k)

$r = 0$

k

$p = 1$

$s = 1$

(open branch)

(since we reached open branch here, we don't need to check other branches.

This open branch contradicts to our starting statement.

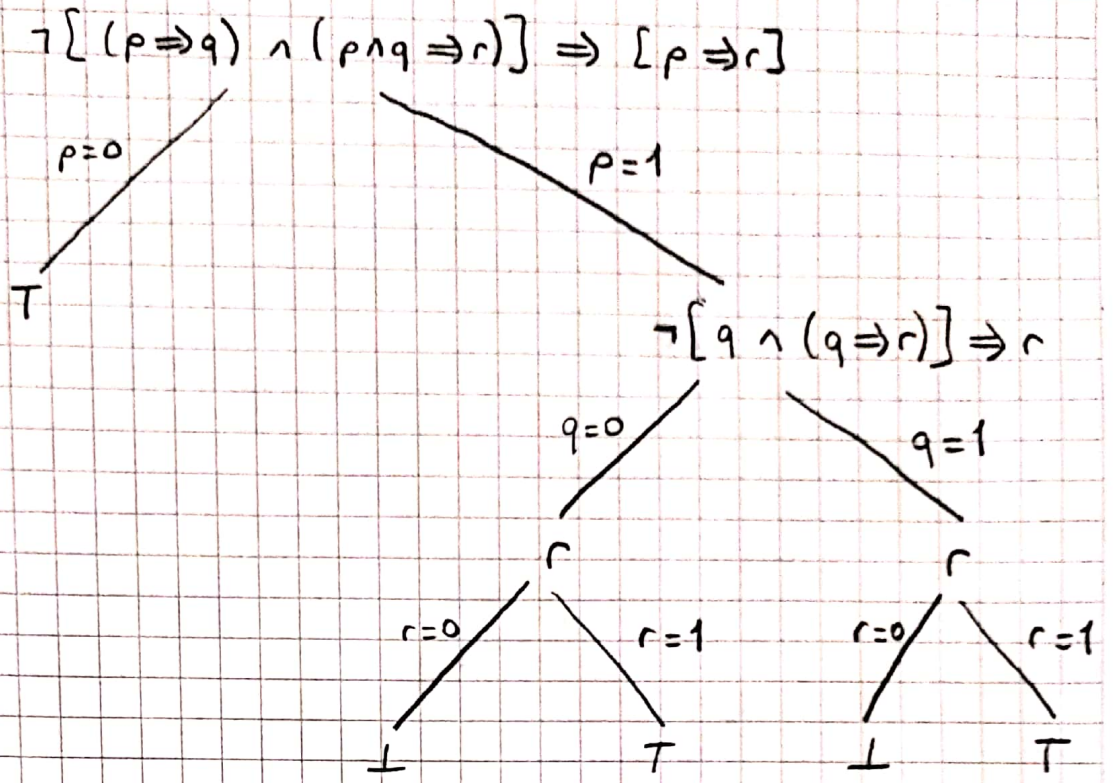
d

$r = 1$

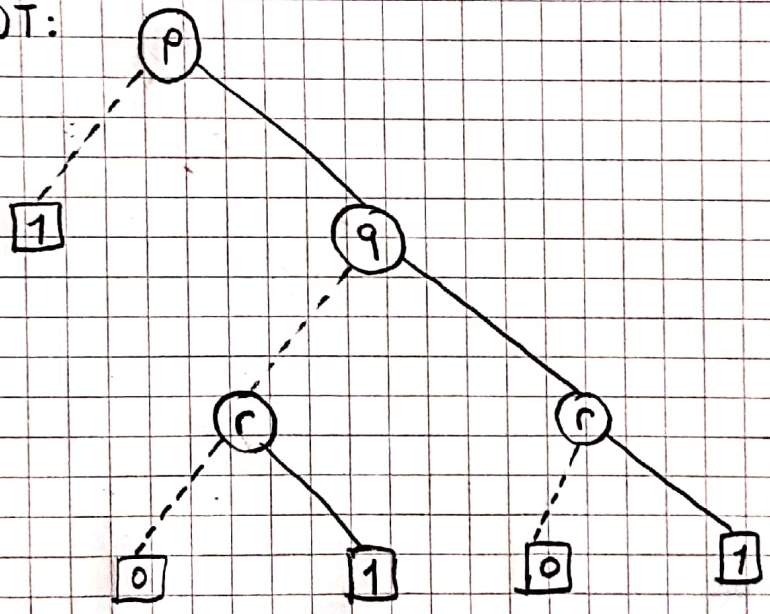
Hence, given equivalence is FALSE.

Question 3-)

a-)



b-) BDT:



c-) BDD: