Digitaltechnik - Übung 3

1.a

1.
$$Z = \left(A \wedge \overline{B \wedge C}\right) \vee A \vee (B \wedge C)$$
$$= A \vee \left((A \vee (B \wedge C)) \wedge \left(\overline{B \wedge C} \vee (B \wedge C)\right)\right)$$
$$= A \vee (A \vee (B \wedge C))$$
$$= A \vee (B \wedge C)$$

2.
$$Z = \left(A \wedge \overline{B \wedge C}\right) \vee \left(A \wedge \overline{\overline{B} \vee \overline{C}}\right)$$
$$= \left(A \wedge \overline{B \wedge C}\right) \vee (A \wedge B \wedge C) = A$$

3.
$$Z = (A \wedge (B \vee C)) \vee (A \wedge \neg C)$$
$$= A \wedge ((B \vee C) \vee \neg C)$$
$$= A$$

4.
$$Z = ((B \wedge \neg C) \wedge (A \vee \neg A)) \vee ((\neg B \wedge C) \wedge (A \vee \neg A))$$
$$= (B \wedge \neg C) \vee (\neg B \wedge C)$$

5.
$$(A \wedge (D \vee (\neg D \wedge \neg C) \vee (C \wedge \neg D))) \vee ((B \wedge C) \wedge (D \vee \neg A))$$
$$A \vee ((B \wedge C) \wedge (D \vee \neg A))$$
$$(A \vee (B \wedge C)) \wedge ((A \vee D) \vee (A \vee \neg A))$$
$$A \vee (B \wedge C)$$

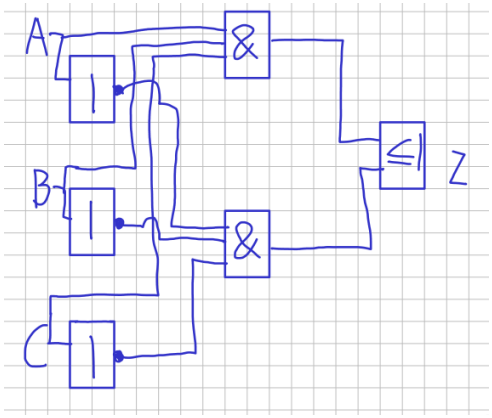
b)

i.
$$Z = (A \wedge B) \vee (B \wedge C)$$
$$\overline{\overline{(A \wedge B) \vee (B \wedge C)}}$$
$$\text{NAND} : \overline{\overline{A \wedge B} \wedge \overline{B \wedge C}}$$
$$\overline{(\neg A \vee \neg B) \wedge (\neg B \vee \neg C)}$$
$$\overline{\neg B \vee (\neg A \wedge \neg C)}$$
$$\text{NOR} : \overline{\neg B \vee \overline{A \vee C}}$$

ii.
$$Z = A \oplus B$$
$$(\neg A \wedge B) \vee (A \wedge \neg B)$$
$$\text{NAND} : \overline{\overline{\neg A \wedge B} \wedge \overline{A \wedge \neg B}}$$
$$(A \vee B) \wedge (\neg A \vee \neg B)$$
$$\text{NOR} : \overline{\overline{A \vee B} \vee \overline{\neg A \vee \neg B}}$$

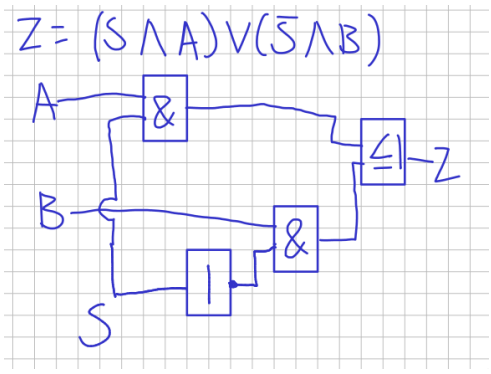
c)

Minterms:
$$(\neg A \wedge \neg B \wedge \neg C) \vee (A \wedge B \wedge C)$$



Error: ≥ 1

2.a

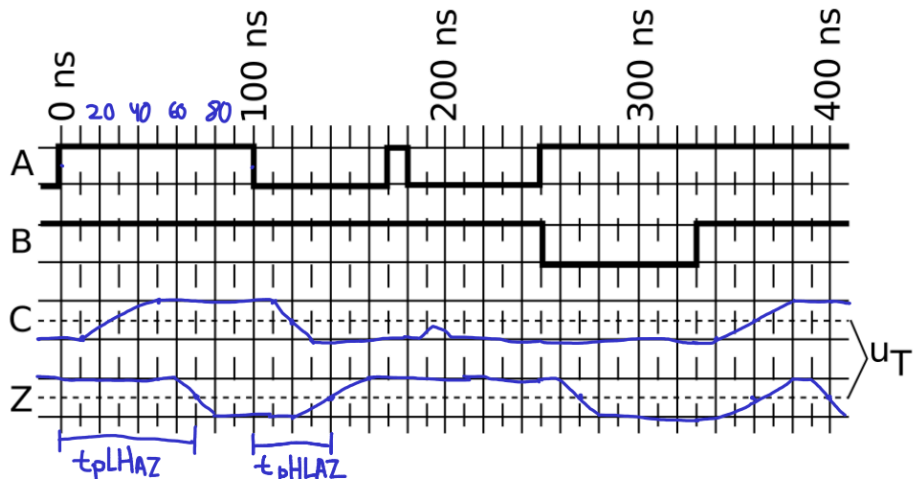


b

Man müsste zumindest eine dritte state zu dem Steuereinheit hinzufügen, zum Beispiel durch 2 Bit Binary Kodierung.

3

a)



b) $t_{pLHAZ} = 70\text{ns}$
$t_{pHLAZ} = 40\text{ns}$