

## Digitaltechnik - Übung 3

### 1.a

$$\begin{aligned} 1. \quad Z &= (A \wedge \overline{B \wedge C}) \vee A \vee (B \wedge C) \\ &= A \vee ((A \vee (B \wedge C)) \wedge (\overline{B \wedge C} \vee (B \wedge C))) \\ &= A \vee (A \vee (B \wedge C)) \\ &= A \vee (B \wedge C) \end{aligned}$$

$$\begin{aligned} 2. \quad Z &= (A \wedge \overline{B \wedge C}) \vee (A \wedge \overline{\overline{B} \vee \overline{C}}) \\ &= (A \wedge \overline{B \wedge C}) \vee (A \wedge B \wedge C) = A \end{aligned}$$

$$\begin{aligned} 3. \quad Z &= (A \wedge (B \vee C)) \vee (A \wedge \neg C) \\ &= A \wedge ((B \vee C) \vee \neg C) \\ &= A \end{aligned}$$

$$\begin{aligned} 4. \quad Z &= ((B \wedge \neg C) \wedge (A \vee \neg A)) \vee ((\neg B \wedge C) \wedge (A \vee \neg A)) \\ &= (B \wedge \neg C) \vee (\neg B \wedge C) \end{aligned}$$

$$\begin{aligned} 5. \quad &(A \wedge (D \vee (\neg D \wedge \neg C) \vee (C \wedge \neg D))) \vee ((B \wedge C) \wedge (D \vee \neg A)) \\ &A \vee ((B \wedge C) \wedge (D \vee \neg A)) \\ &(A \vee (B \wedge C)) \wedge ((A \vee D) \vee (A \vee \neg A)) \\ &A \vee (B \wedge C) \end{aligned}$$

### b)

i.

$$\begin{aligned} Z &= (A \wedge B) \vee (B \wedge C) \\ &\overline{\overline{(A \wedge B) \vee (B \wedge C)}} \\ \text{NAND : } &\overline{\overline{A \wedge B} \wedge \overline{B \wedge C}} \\ &\overline{(\neg A \vee \neg B) \wedge (\neg B \vee \neg C)} \\ &\overline{\neg B \vee (\neg A \wedge \neg C)} \\ \text{NOR : } &\overline{\neg B \vee \overline{A \vee C}} \end{aligned}$$

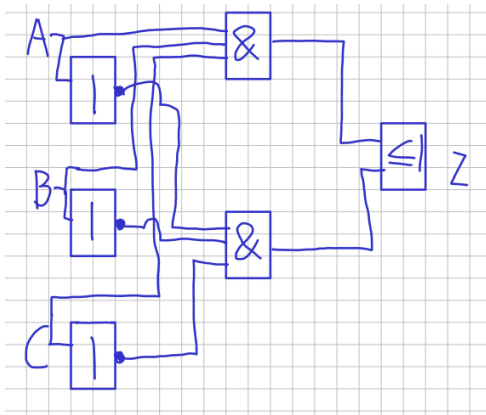
ii.

$$\begin{aligned} Z &= A \oplus B \\ &(\neg A \wedge B) \vee (A \wedge \neg B) \\ \text{NAND : } &\overline{\overline{\neg A \wedge B} \wedge \overline{A \wedge \neg B}} \\ &(A \vee B) \wedge (\neg A \vee \neg B) \\ \text{NOR : } &\overline{\overline{A \vee B} \vee \overline{\neg A \vee \neg B}} \end{aligned}$$

### c)

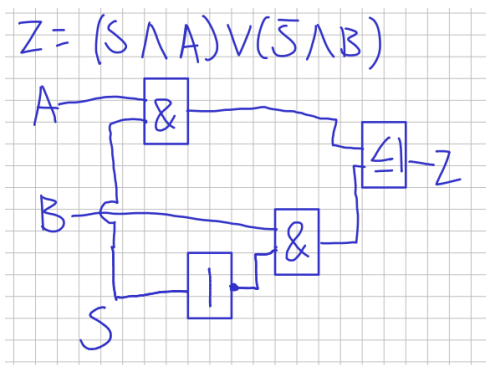
Minterms:

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



Error:  $\geq 1$

**2.a**

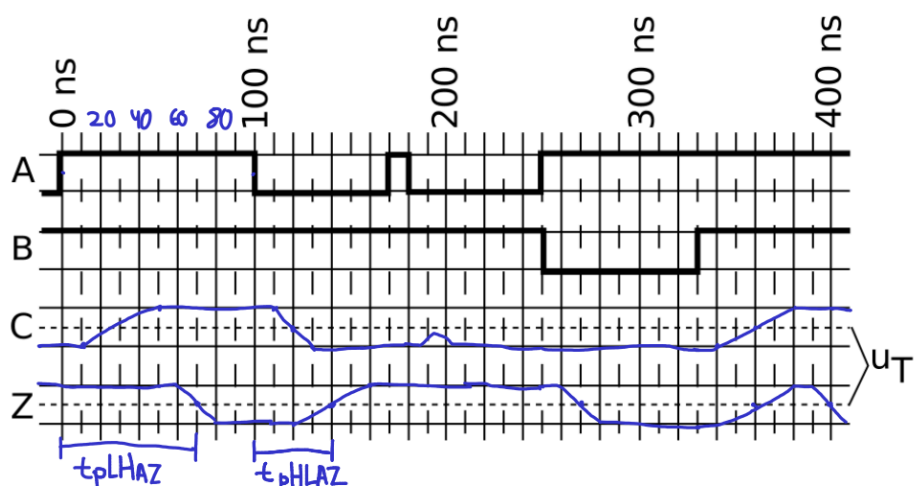


**b**

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

**3**

a)



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

$t_{pHLAZ} = 40\text{ns}$