Homework #1

1. A machine with 4.2 GHz clock rate. What is its clock cycle time? *

$$4.2 \text{ GHz} = 4.2 \times 10^{-9} \text{ sec} = 4200 \times 10^{-12} \text{ sec}$$
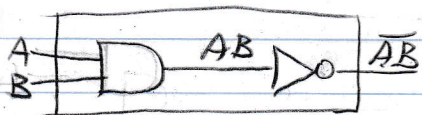
$$\boxed{4.2 \text{ GHz} = 4200 \text{ picoseconds}}$$

2. Program P has 12×10^{11} instructions. A 4 GHz machine has an average CPI of 2. What is the expected cpu time?

$$\text{cpu time} = [\text{instruction count} \times \text{CPI}] / \text{clock rate}$$
$$= [(12 \times 10^{11}) \times (2) \text{ cycles}] / 4 \times 10^9 \text{ cyc/sec}$$
$$= \frac{24 \times 10^{11} \text{ cyc} \cdot \text{sec}}{4 \times 10^9 \text{ cyc}}$$
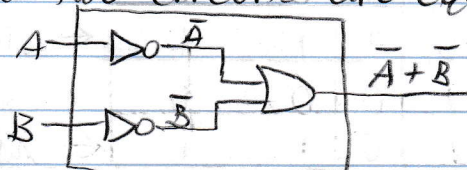$$= 6 \times 10^2 \text{ sec}$$
$$\boxed{\text{cpu time} = 600 \text{ seconds}}$$

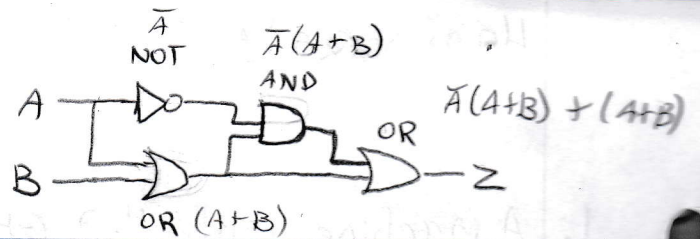3. use a truth table to prove the two circuits are equivalent.

NAND

A	B	$\overline{AB}$
0	0	1
0	1	1
1	0	1
1	1	0

$\equiv$

Negative OR

A	B	$\overline{A} + \overline{B}$
0	0	1
0	1	1
1	0	1
1	1	0

$$\overline{A}\ \text{NOT} \qquad \overline{A}(A+B)\ \text{AND} \qquad \overline{A}(A+B)+(A+B)\ \text{OR}$$

OR $(A+B)$

4. Given the logic circuit,
   a) write a logic equation for it.

$$\boxed{Z = \overline{A}B + (A+B)}$$

* $\overline{A}A = F$

$\overline{A}A + \overline{A}B = F + \overline{A}B$

* This can be simplified
  as $Z = A+B$

b) when $A=1$ and $B=0$, what is z?

$$\boxed{Z \text{ is true when } A=1 \text{ and } B=0}$$

* $z = (\overline{1})(0) + (1+0)$

$z = 0 + 1$

$z = 1$

5. use 2-input AND, 2-input OR and inverter gates only to construct a circuit from the truth table.

input			output
A	B	C	X
0	0	0	1
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	0

← $\overline{ABC}$

← $\overline{A}BC$

← $A\overline{B}C$

← $AB\overline{C}$

$$X = (\overline{ABC}) + (\overline{A}BC) + (AB\overline{C}) + (A\overline{B}C)$$

$\overline{A}$ $\overline{ABC}$

$(\overline{ABC}) + (\overline{A}BC)$

$\overline{A}BC$

$AB\overline{C}$

$(AB\overline{C}) + (A\overline{B}C)$

$\overline{ABC}$

X