Digital Electronics
ECT 213

Test #1 Review
Answers

Hint for the test:

- Do NOT memorize answers (I will ask you to put definitions and other answers in your own words. Memorized answers will NOT receive full points) I want to know what you understand, not how well you can memorize!

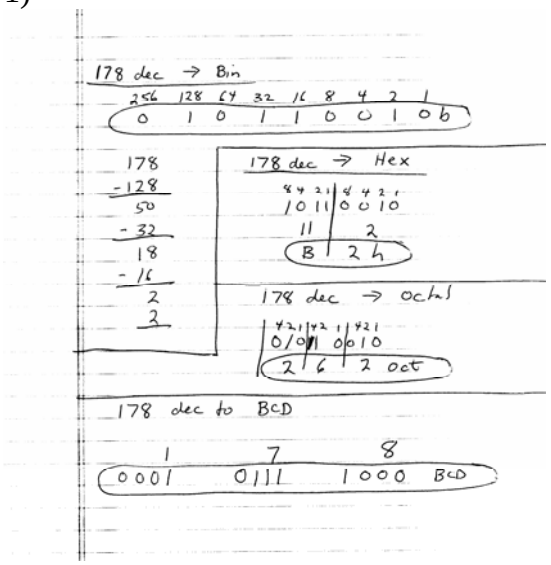
Chapter 1

1) What is the difference between an analog signal and a digital signal?
   - Analog signals consist of continuous waveforms (varies slowly from one value to another, for example a sin wave)
   - Digital signals consist of discrete levels (ie 5v and ground ONLY)
2) For TTL:
   a. What is the voltage minimum for a logic high?
      2.7v
   b. What is the voltage maximum for a logic low?
      0.7v
   c. What do we usually consider a High and LOW?
      5v and 0v

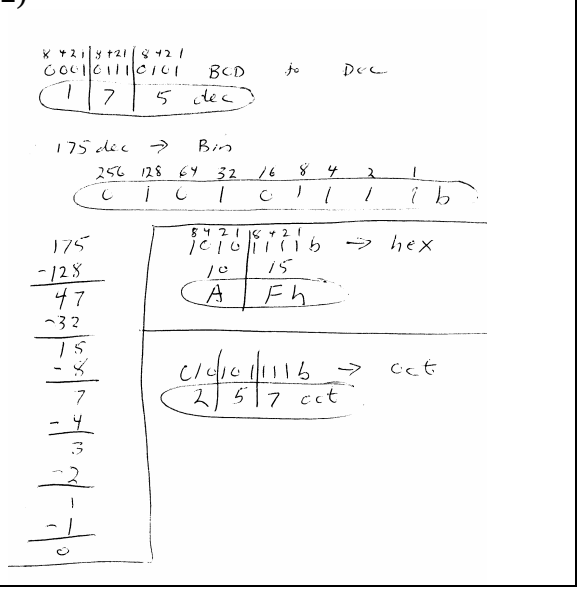
3) Conversions (similar table to HW) Show your work or no partial credit will be given.

	a) Decimal	b) BCD	c) Hex	d) Octal	e) Binary
1	**178**	000101111000	B2	262	10110010
2	175	**000101110101**	AF	257	10101111

1)



2)



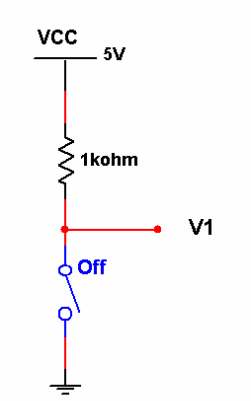
For more practice goto
http://www.ncatecit.info/spring_2008/ect213/assignments/login.php do NOT put a name or banner id and select NUMBER SYSTEMS. This will give a random set of questions. Print out the sheet, work them out, then log back in (no user name, but use the Student ID number as the BANNER number.) You do not need to type your answers, just hit submit to see the correct answers.

Chapter 2

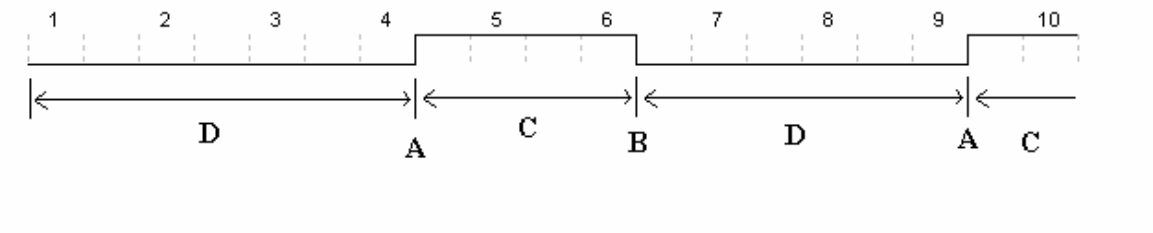
4) What is meant by "Discrete Levels"?

the value can only be certain values, in the case of TTL voltage levels, 0 or 5 volts.

5) Draw the circuit needed to supply the correct input values to a digital logic circuit such that a closed switch will produce a LOGIC 0 and a open switch will produce a Logic 1.



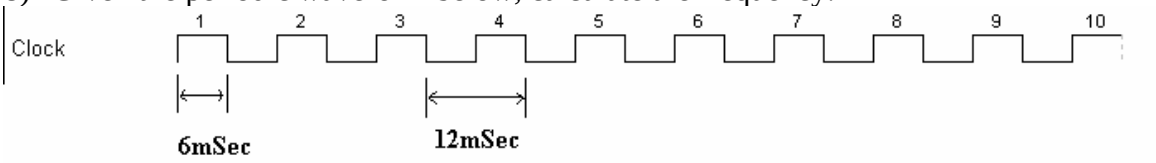
6) On the waveform below, indicate the following:
   a. A rising edge
   b. A Falling edge
   c. High
   d. Low



7) What is the difference between a periodic and non-periodic waveform?

A periodic waveform repeats its pattern over and over again within one period, a non periodic waveform (in digital logic) has highs and lows that do not repeat.

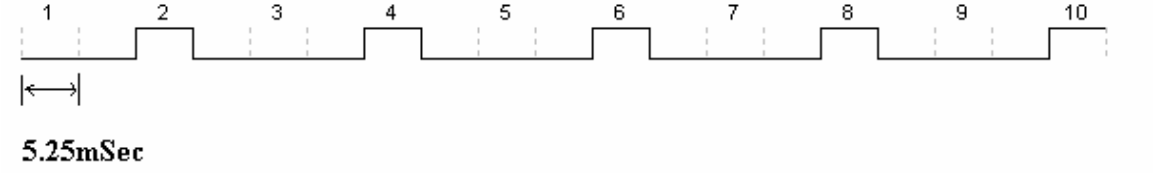
8) Given the periodic waveform below, calculate the frequency.



since a full period (time from a rising edge to a rising edge or falling edge to falling edge) is 12 mSec

$$f = \frac{1}{t}$$
$$= \frac{1}{.012\,\text{sec}}$$
$$= 83.33Hz$$

9) Given the waveform below, calculate the duty cycle.



since one full period is 4 blocks long, t = 5.25mSec * 4

$$f = \frac{1}{t}$$
$$= \frac{1}{.021\text{sec}}$$
$$= 47.62Hz$$

now duty cycle is the:

$$duty = \frac{t_{on}}{T} * 100$$
$$= \frac{.00525}{.021} * 100$$
$$= 25\%$$

10) What does TTL stand for?

Transistor Transistor Logic

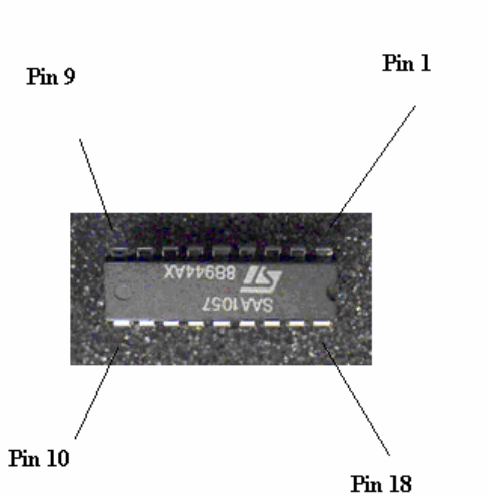
11) What is a logic probe?

A logic probe is a device used to test digital logic systems. The typical logic probe requires power and ground, and has a tip that can be touched to a pin and indicate the state of the pin (high, low, or NOT CONNECTED) by 2 LED lights (one for High, another for LOW, and both OFF indicates not connected).

12) What are the similarities and differences of an oscilloscope and a digital analyzer?

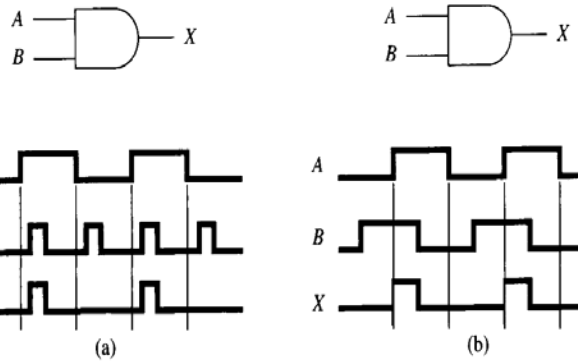
Both an oscilloscope and digital analyzer show waveforms in real time, but an oscilloscope typically shows 2 analog waves, where a digital analyzer allows you to show many (typically a multiple of 8) digital waveforms.

13) Given the IC below, indicate pin 1 and pin 9.

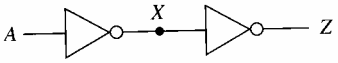


Chapter 3

14) **3–7.** Sketch the output waveform at *X* for the two-input AND gates shown in Figure P3–7.



15) **3–26.** For Figure P3–26, write the Boolean equation at *X* and *Z*. If $A = 0$, what is *X*? What is *Z*?



$X = \overline{A}$

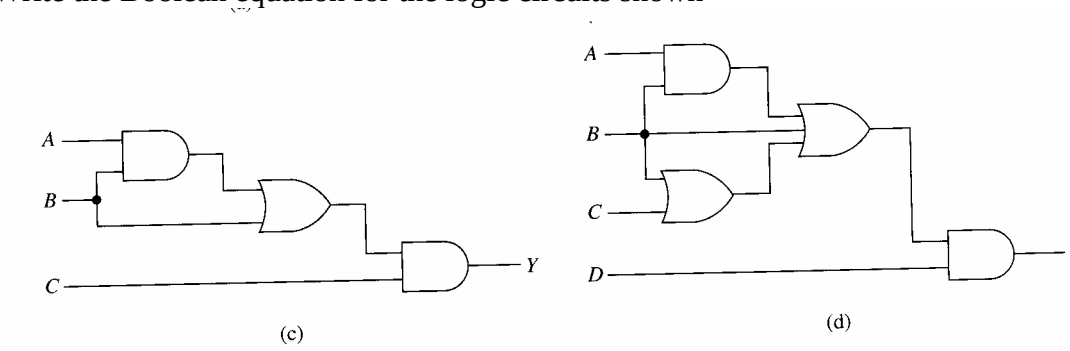
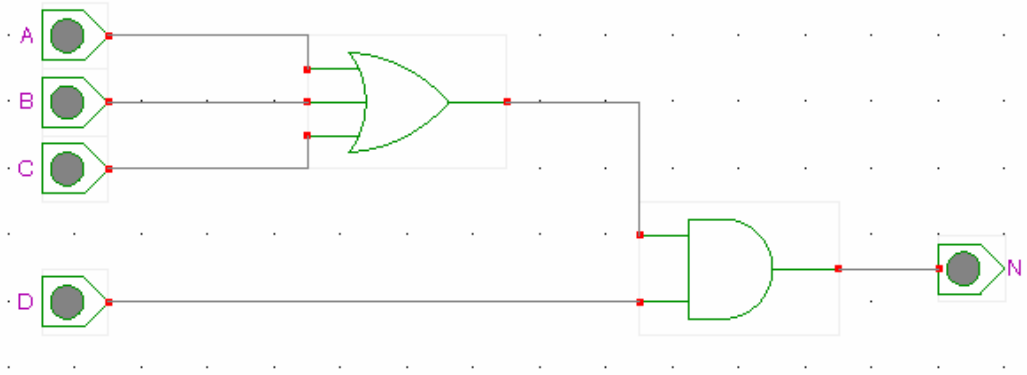
$Z = \overline{X} = \overline{\overline{A}} = A$

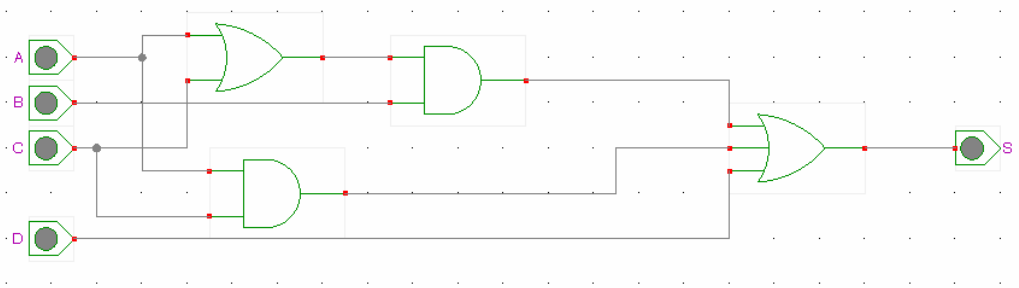
If A=0, X = 1 and Z = 0.

16) Create a truth table for a 2 input NOR gate.

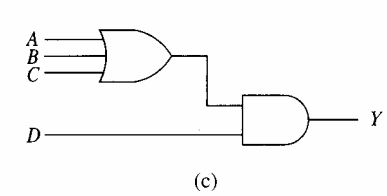
A	B	OR	NOR
0	0	0	1
0	1	1	0
1	0	1	0
1	1	1	0

Chapter 5

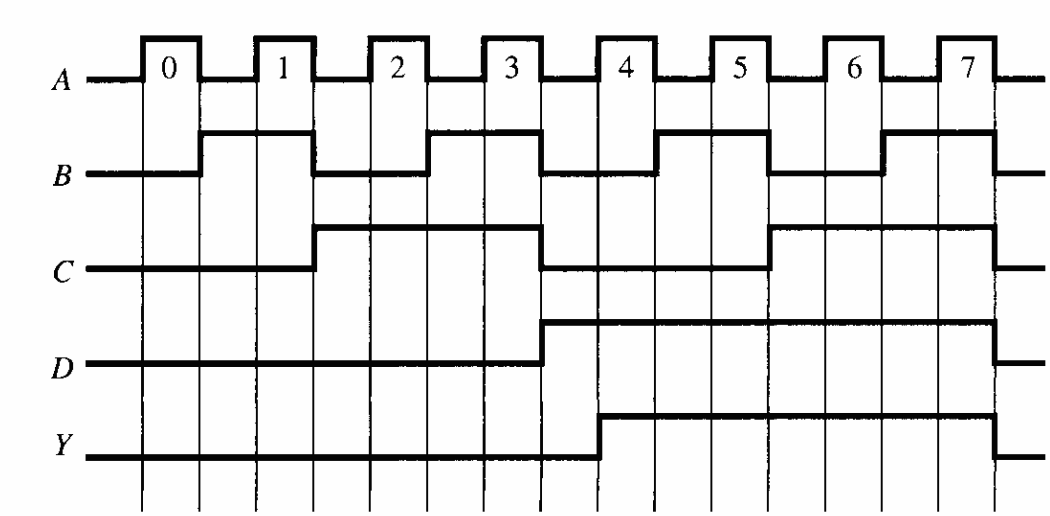
17)	Write the Boolean equation for the logic circuits shown  $Y = C(AB + B)$ $X = D(AB + B + B + C)$
18)	Draw the circuit for the given Boolean expression: $N = (A + B + C)D$ 
19)	Draw the circuit for the given Boolean expression: $S = B(A + C) + AC + D$



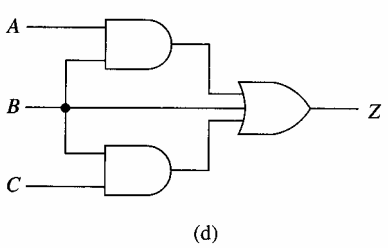
20) Write the Boolean expression and complete the timing diagram for the circuit below:



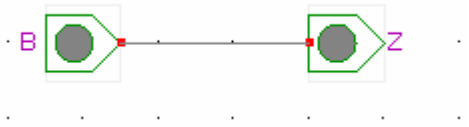
$$Y = D(A + B + C)$$



21) Write the Boolean expression for the following circuit, then simplify the equation and draw the simplified circuit.

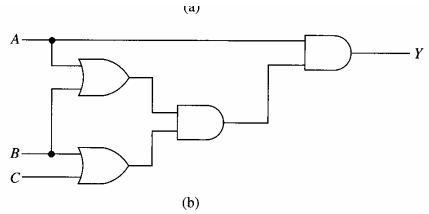


(d)



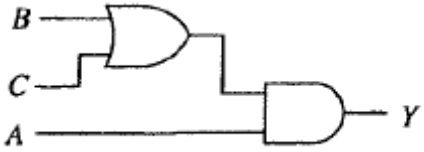
$$Z = AB + B + BC$$
$$Z = B(A + 1 + C)$$
$$Z = B$$

22) Write the Boolean expression for the following circuit, then simplify the equation and draw the simplified circuit.



(b)

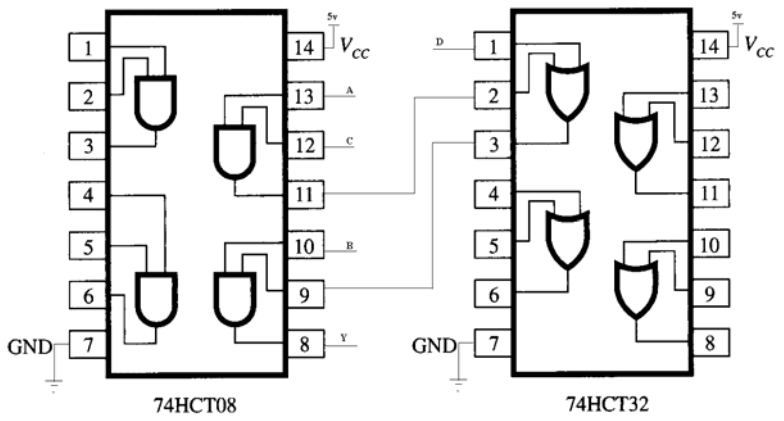
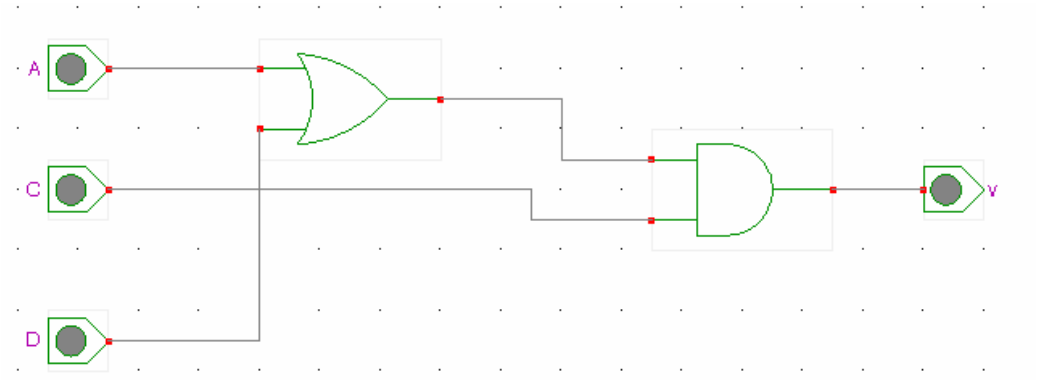
$$Y = A((A + B)(B + C)$$
$$Y = A(AB + AC + BB + BC)$$
$$Y = AAB + AAC + ABB + ABC$$
$$Y = AB + AC + AB + ABC$$
$$Y = AB + AC + ABC$$
$$Y = AB(1 + C) + AC$$
$$Y = AB + AC$$
$$Y = A(B + C)$$

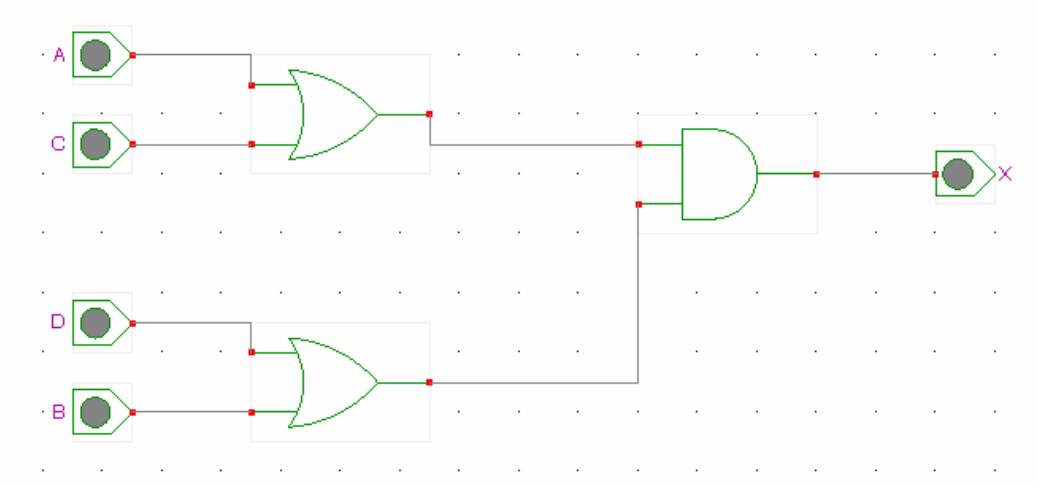


23) **5–11.** The pin layouts for a 74HCT08 CMOS AND gate and a 74HCT32 CMOS OR gate are given in Figure P5–11. Make the external connections to the chips to implement the following logic equation. (Simplify the logic equation first.)

$$Y = AB(C + BD) + BD$$

$$Y = ABC + ABBD + BD$$
$$Y = ABC + ABD + BD$$
$$Y = ABC + BD(A + 1)$$
$$Y = ABC + BD$$
$$Y = B(AC + D)$$

	
24)	Draw the circuit for the given Boolean expression, simplify and then draw the new circuit. $V = AC + ACD + CD$ $V = AC(1+D) + CD$ $V = AC + CD$ $V = C(A+D)$ 
25)	Draw the circuit for the given Boolean expression, simplify and then draw the new circuit. $X = (B + D)(A + C) + ABD$ $X = BA + BC + AD + DC + ABD$ $X = AB(1+D) + BC + AD + DC$ $X = AB + BC + AD + DC$ $X = B(A+C) + D(A+C)$ $X = (A+C)(B+D)$



26)

5–17. Draw the logic circuit for the following equations. Apply De Morgan's theorem and Boolean algebra rules to reduce them to equations having inversion bars over single variables only. Draw the simplified circuit.

(a) $W = \overline{AB} + \overline{A + C}$

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

(c) $Y = \overline{(AB)} + \overline{C} + B\overline{C}$

(d) $Z = AB + \overline{(\overline{A} + C)}$

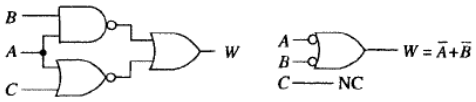
a)

$W = \overline{AB} + \overline{A + C}$

$= \overline{A} + \overline{B} + \overline{A}\,\overline{C}$

$= \overline{A}(1 + \overline{C}) + \overline{B}$

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



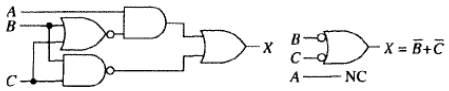
b)

$X = A\overline{B + C} + \overline{BC}$

$= A\overline{B}\,\overline{C} + \overline{B} + C$ $\quad A\overline{B}\,\overline{C} + \overline{B} + \overline{C}$

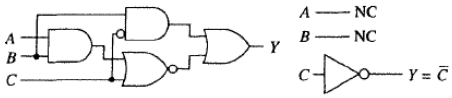
$= \overline{B}(A\overline{C} + 1) + \overline{C}$ $\quad \overline{C}(A\overline{B} + 1) + \overline{B}$

$= \overline{B} + \overline{C}$ $\quad \overline{C} + \overline{B}$



c)

$$c)\ Y = \overline{(AB)}\,\overline{+C} + B\bar{C}$$
$$= AB\bar{C} + B\bar{C}$$
$$= (\bar{A}+\bar{B})\bar{C} + B\bar{C}$$
$$= \bar{C}\,(B + (\bar{A}+\bar{B}))$$
$$= \bar{C}\,(B + \bar{A} + \bar{B})$$
$$= \bar{C}\,(\bar{A} + 1)$$
$$= \bar{C}$$



d)

$$d)\ Z = \overline{AB + (\bar{A} + C)}$$
$$= \overline{AB}\,\overline{(\bar{A} + C)}$$
$$= (\bar{A}+\bar{B})\,(\bar{A}\cdot\bar{C})$$
$$= (\bar{A}+\bar{B})\,(A\bar{C})$$
$$= \bar{A}A\bar{C} + A\bar{B}\bar{C}$$
$$= 0 + A\bar{B}\bar{C}$$
$$= A\bar{B}\bar{C}$$