3-3-22

Chapter 2 Homework Cover Page

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* Problems Solved :

2.1 : 6, 12, 18, 24, 30, 36, 42, 48 (ALL problems)

2.2 : 6, 12, 18, 24, 30, 36, 42, 48 (ALL Problems)

2.3 : 6, 12, 18, 24, 30, 36, 42 (ALL Problems)

2.4 : 6, 12, 18, 24, 30 (ALL Problems)

2.5 6, 12, 18, 24, 30, 36, 42 (ALL Problems)

* Problems Not Solved : NONE

Chapter 2 Section 1 Problem 6

Write the statements in 6-9 in symbolic form using $\sim$, $\wedge$, and $\vee$ and the indicated letters to represent component statements.

Let s = "stocks are increasing" and i = "interest rates are steady."

a) Stocks are increasing but interest rates are steady.

$\rightarrow$ $s \wedge i$

b) Neither are stocks increasing nor are interest rates steady.

$\rightarrow$ $\sim s \wedge \sim i$

($\sim s$ = stocks are not increasing)

($\sim i$ = interest rates aren't steady)

Ch. 2 Sect. 1 Prob. 12

Write truth tables for the statement forms in 12-15.

Statement form: $\sim p \wedge q$

p	q	$\sim p$	$\sim p \wedge q$
T	T	F	F
T	F	F	F
F	T	T	T
F	F	T	F

Ch. 2 Sect. 1 Prob. 18

Determine whether the statement forms are logically equivalent. Construct a truth table and include a sentence justifying your answer.

$p \vee t$ and t

p	t	$p \vee t$
T	T	T
F	T	T

- t and $p \vee t$ have the same truth values, so they're logically equivalent.

Ch. 2 Sect. 1 Prob. 24

Determine whether the statement forms are logically equivalent. Construct a truth table and include a sentence justifying your answer.

$(p \vee q) \vee (p \wedge r)$ and $(p \vee q) \wedge r$

p	q	r	$p \vee q$	$p \wedge r$	$(p \vee q) \vee (p \wedge r)$	$(p \vee q) \wedge r$
T	T	T	T	T	T	T
T	T	F	T	F	T	F
T	F	T	T	T	T	T
T	F	F	T	F	T	F
F	T	T	T	F	T	T
F	T	F	T	F	T	F
F	F	T	F	F	F	F
F	F	F	F	F	F	F

- Since $(p \vee q) \vee (p \wedge r)$ and $(p \vee q) \wedge r$ have different truth values, they are not logically equivalent.

Ch. 2 Sect. 1 Prob. 30

Use De Morgan's laws to write the negation for the statement.

The dollar is at an all time high and the stock market is at a record low.

$\sim(p \wedge q) \equiv \sim p \vee \sim q$

p = The dollar is at an all time high

q = The stock market is at a record low.

$\sim p \vee \sim q$ = The dollar is not at an all time high, or the stock market is not at a record low.

Ch. 2. Sect. 1 Prob. 36

Assume x is a particular real # and use De Morgan's laws to write a negation for:

$$\underbrace{1 > x \geq -3}_{\text{Part 1 Part 2}} \qquad (1 > x \text{ and } x \geq -3)$$

For $1 > x$:

$\sim(1 > x) = 1 \leq x$

For $x \geq -3$:

$\sim(x \geq -3) = x < -3$

Negations:

$\sim(<) = \geq$

$\sim(>) = \leq$

$\sim(\leq) = >$

$\sim(\geq) = <$

Put together:

$1 \leq x$ or $x < -3$

Ch. 2 Sect. 1 Prob. 42

Use a truth table to determine if the statement form is a tautology or contradiction

$((\sim p \wedge q) \wedge (q \wedge r)) \wedge \sim q$

p	q	r	$\sim p$	$\sim q$	$\sim p \wedge q$	$q \wedge r$
T	T	T	F	F	F	T
T	T	F	F	F	F	F
T	F	T	F	T	F	F
T	F	F	F	T	F	F
F	T	T	T	F	T	T
F	T	F	T	F	T	F
F	F	T	T	T	F	F
F	F	F	T	T	F	F

$((\sim p \wedge q) \wedge (q \wedge r))$	$((\sim p \wedge q) \wedge (q \wedge r)) \wedge \sim q$
F	F
F	F
F	F
F	F
T	F
F	F
F	F
F	F

- Since the truth values are always F, $((\sim p \wedge q) \wedge (q \wedge r)) \wedge \sim q$ is a contradiction.

Ch. 2 Sect 1 Prob 48

A logical equivalence is derived. Supply a reason for each step.

① $(p \wedge \sim q) \vee (p \wedge q) \equiv p \wedge (\sim q \vee q)$ by distributive law.

② $\equiv p \wedge (q \vee \sim q)$ by commutative law for $\vee$.

③ $\equiv p \wedge t$ by negation law for $\vee$.

④ $\equiv p$ by identity law for $\wedge$

* Distributive Law: $p \wedge (q \vee r) \equiv (p \wedge q) \vee (p \wedge r)$

* Commutative Law for $\vee$: $p \vee q \equiv q \vee r$

* Negation Law for $\vee$: $p \vee \sim p \equiv t$

* Identity Law for $\wedge$: $p \wedge t \equiv p$.

Ch. 2 Sect. 2 Prob. 6

Construct a truth table.

$(p \vee q) \vee (\sim p \wedge q) \rightarrow q$

p	q	$\sim p$	$p \vee q$	$\sim p \wedge q$	$(p \vee q) \vee (\sim p \wedge q)$
T	T	F	T	F	T
T	F	F	T	F	T
F	T	T	T	T	T
F	F	T	F	F	F

$(p \vee q) \vee (\sim p \wedge q) \rightarrow q$

T

F

T

T

* The only time an if then is false is if the premise is true and the conclusion is false. Otherwise, it is always true.

Ch. 2 Sect. 2 Prob. 12

Use logical equivalence to rewrite the following statement. (Assume x represents a fixed real number).

we know that $p \vee q \to r \equiv (p \to r) \wedge (q \to r)$.

If $\underbrace{x > 2}_{p}$ or $\underbrace{x < -2}_{q}$, then $\underbrace{x^2 > 4}_{r}$.

$p \quad \vee \quad q \quad \to \quad r$

$\to (p \to r) \wedge (q \to r) =$

If $\underbrace{x > 2, \text{ then } x^2 > 4}_{(p \to r)}$ and $\underbrace{\text{if } x < -2, \text{ then } x^2 > 4}_{(q \to r)}$.

$(p \to r) \quad \wedge \quad (q \to r)$

Ch. 2 Sect. 2 Prob. 18

Write each of the 3 statements in symbolic form and determine which pairs are logically equivalent. Include truth tables and a few words of explanation.

① If it walks like a duck and it talks like a duck, then it is a duck

* Let p = walks like a duck and q = talks like a duck and r = it is a duck. Then,

→ $p \wedge q \rightarrow r$ (① in symbolic form)

② Either it does not walk like a duck or it does not talk like a duck, or it is a duck.

→ $\sim p \vee \sim q \vee r$ (② in symbolic form)

③ If it does not walk like a duck and it does not talk like a duck, then it is not a duck.

→ $\sim p \wedge \sim q \rightarrow \sim r$ (③ in symbolic form)

p	q	r	$\sim p$	$\sim q$	$\sim r$	$p \wedge q$	$p \wedge q \rightarrow r$ ①	$\sim p \vee \sim q$	$\sim p \vee \sim q \vee r$ ②
T	T	T	F	F	F	T	T	F	T
T	T	F	F	F	T	T	F	F	F
T	F	T	F	T	F	F	T	T	T
T	F	F	F	T	T	F	T	T	T
F	T	T	T	F	F	F	T	T	T
F	T	F	T	F	T	F	T	T	T
F	F	T	T	T	F	F	T	T	T
F	F	F	T	T	T	F	T	T	T

$\sim p \wedge \sim q$	$\sim p \wedge \sim q \rightarrow r$ ③
F	T
F	T
F	T
F	T
F	T
F	T
T	T
T	F

* From the truth table, ① and ② have the same truth values, so they are logically equivalent. ③ is not logically equivalent to any statement form.

Ch. 2 Sect. 2 Prob. 24

Use a truth table to establish the truth of the statement.

A conditional statement is not logically equivalent to its converse. ($p \to q$ & $q \to p$)

p	q	$p \to q$	$q \to p$	
T	T	T	T	(1) Row 1
T	F	F	T	(2) Row 2
F	T	T	F	(3) Row 3
F	F	T	T	(4) Row 4

* Since, $p \to q$ and $q \to p$ don't have identical truth values, they are not logically equivalent.

(2nd and 3rd rows have different truth values.

Ch. 2 Sect. 2 Prob. 30

If statement forms P and Q are logically equivalent, then $P \leftrightarrow Q$ is a tautology. Conversely, if $P \leftrightarrow Q$ is a tautology, then P and Q are logically equivalent. Use $\leftrightarrow$ to convert each of the logical equivalences to a tautology. Then use a truth table to verify the tautology.

$p \wedge (q \vee r) \equiv (p \wedge q) \vee (p \wedge r)$

Let $P = p \wedge (q \vee r)$ and let $Q = (p \wedge q) \vee (p \wedge r)$

$\Rightarrow$ we get $P \equiv Q$, so $P \leftrightarrow Q$ is a tautology.

						P	Q
p	q	r	$p \wedge q$	$p \wedge r$	$q \vee r$	$p \wedge (q \vee r)$	$(p \vee q) \vee (p \wedge r)$
T	T	T	T	T	T	T	T
T	T	F	T	F	T	T	T
T	F	T	F	T	T	T	T
T	F	F	F	F	F	F	F
F	T	T	F	F	T	F	F
F	T	F	F	F	T	F	F
F	F	T	F	F	T	F	F
F	F	F	F	F	F	F	F

$P \leftrightarrow Q$
$p \wedge (q \vee r) \leftrightarrow (p \wedge q) \vee (p \wedge r)$
T
T
T
T
T
T
T
T

* Since $P \leftrightarrow Q$ has all T's, it is a tautology. This means that P and Q are logically equivalent (they have identical truth values).

* Since $P \equiv Q$, then $P \leftrightarrow Q$ is a tautology which is what we tried to show.

Ch. 2 Sect. 2 Prob. 36

Taking the long view on your education, you go to the Prestige Corporation and ask what you should do in college to be hired when you graduate. The personnel director replies that you will be hired "only if" you major in mathematics or computer science, get a B average or better, and take accounting. You do, in fact, become a math major, get a B+ average, and take accounting. You return to Prestige Corporation, make a formal application, and are turned down. Did the personnel director lie to you?

"P only if Q" is of the form $P \to Q$ and more specifically, it means $\sim Q \to \sim P$ (contrapositive of $P \to Q$).

Let P = you will be hired and Q = you major in mathematics or computer science, get a B average or better, and take accounting.

→ $\sim Q \to \sim P$ = If you don't major in math or comp. sci., don't get a B average or better, and don't take accounting, then you won't be hired.

* The statement given by $\sim Q \to \sim P$ says nothing about what will happen if you do satisfy all the conditions, it only says what will happen if you don't meet the requirements.

* The statement is false iff its negation is true.

$P \to Q \equiv \sim P \vee Q$, then $\sim(P \to Q) \equiv \sim(\sim P \vee Q) \equiv P \wedge \sim Q$

→ $P \wedge \sim Q$ = You will be hired and you don't have to major in math or comp sci..

Since the negation isn't true, the director's statement wasn't a lie.

Ch. 2 Sect. 2 Prob. 42

Use the contrapositive to rewrite the statement in if-then form in 2 ways.

Being divisible by 3 is a necessary condition for this number to be divisible by 9.

If r, s are statements, "r is a necessary condition for s" means that if $s \to r$ or if $\sim r \to \sim s$.

r = being divisible by 3

s = this number is divisible by 9.

① $s \to r$: If this number is divisible by 9, then it is divisible by 3.

② $\sim r \to \sim s$: If this number is not divisible by 3, then it is not divisible by 9.

Ch. 2 Sect. 2 Prob. 48

a) Use logical equivalences $p \to q \equiv \sim p \vee q$ and $p \leftrightarrow q \equiv (\sim p \vee q) \wedge (\sim q \vee p)$ to rewrite the statement formed w/o using the symbol $\to$ or $\leftrightarrow$.

b) Use the logical equivalences $p \vee q \equiv \sim(\sim p \wedge \sim q)$ to rewrite the statement form using only $\wedge$ and $\sim$.

* $p \vee \sim q \to r \vee q$

For a)

Let $P = p \vee \sim q$ and $Q = r \vee q$

$\to$ $P \to Q \equiv \sim P \vee Q \equiv \sim(p \vee \sim q) \vee (r \vee q)$

$\equiv (\sim p \wedge q) \vee (r \vee q)$

For b)

From part a), we found that $p \vee \sim q \to r \vee q$ is the same as $(\sim p \wedge q) \vee (r \vee q)$ w/o using the $\to$ symbol. Now, we use the fact that $p \vee q \equiv \sim(\sim p \wedge \sim q)$ to finish b) off.

$\to$ Let $P = (\sim p \wedge q)$ and $Q = (r \vee q)$

$P \vee Q \equiv \sim(\sim P \wedge \sim Q) \equiv \sim(\sim(\sim p \wedge q) \wedge \sim(r \vee q))$

$\equiv \sim(\sim(\sim p \wedge q) \wedge (\sim r \wedge \sim q))$

So, $p \vee \sim q \to r \vee q \equiv \sim(\sim(\sim p \wedge q) \wedge (\sim r \wedge \sim q))$.

Ch. 2 Sect. 3 Prob. 6

Use a truth table to determine if the argument form is valid. Indicate which columns represent the premises and which are represents the conclusion. Explain how the truth table supports your answer.

$p \to q$
$q \to p$
$\therefore p \vee q$

		Premises		Conclusion	
p	q	$p \to q$	$q \to p$	$p \vee q$	
T	T	T	T	T	1
T	F	F	T		2
F	T	T	F		3
F	F	T	T	F	4

* we only need to look on the rows in which all of our premises are true, so rows 1 and 4.

* An argument form is valid means that if the premises are all true, that the conclusion also has to be true.

→ Only row 1 is a valid argument form. Since row 4 has a false conclusion, it is an invalid argument form.

Ch. 2 Sect. 3 Prob. 12

Use truth tables to show that the following argument forms are invalid.

a) $p \to q$

q

$\therefore p$

(Converse Error)

	[Premises]		conclusion	
p	q	$p \to q$	p	
T	T	T	T	①
T	F	F		②
F	T	T	F	③
F	F	T		④

Row ③ shows that we can have true premises but a false conclusion, so this argument form is invalid.

b) $p \to q$

$\sim p$

$\therefore \sim q$

(Inverse Error)

		[Premises]		Conclusion	
p	q	$p \to q$	$\sim p$	$\sim q$	
T	T	T	F		①
T	F	F	F		②
F	T	T	T	F	③
F	F	T	T	T	④

Row ③ shows that an argument of this form can have true premises but a false conclusion. This arg. form is invalid.

Ch. 2 Sect. 3 Prob. 18

Use truth tables to show the arg. form referred to is valid. Indicate premise columns and conclusion column. Include a sentence explaining your answer.

Example 2.3.5(a) $p \vee q$

$\sim q$

$\therefore p$

		premises		conclusion	
p	q	p ∨ q	~q	p	
T	T	T	F		1
T	F	T	T	T	2
F	T	T	F		3
F	F	F	T		4

Row 2 represents the only case in which all premises are true, and because the conclusion is also true, the argument form is valid.

Ch. 2 Sect. 3 Prob. 24

Use symbols to write the logical form of the argument. If valid, identify the rule of inference that guarantees the argument's validity. Otherwise, state whether a converse or inverse error was made.

If Jules solved this problem correctly, then Jules obtained the answer 2.
Jules obtained the answer 2.
∴ Jules solved this problem correctly.

Let P = Jules solved this problem correctly
Let Q = Jules obtained the answer 2.

→ $P \to Q$ * In this argument form, a
Q converse error was made.
$\therefore P$ INVALID.

Ch. 2 Sect 3. Prob 30

Use symbols to write the logical form of the argument. If valid, identify the rule of inference. Otherwise, state if a converse / inverse error was made.

If this computer program is correct, then it produces the correct output when run w/ the test data my teacher gave me.
This computer program produces the correct output when run w/ the test data my teacher gave me.
∴ This computer program is correct.

Let P = this computer program is correct.
Let Q = it produces the correct output when run w/ the test data my teacher gave me.

→ $P \to Q$ INVALID:
Q Converse
$\therefore P$ Error

Ch. 2 Sect. 3 Prob. 30

Given the following info about a computer program, find the mistake in the program.

a. There is an undeclared variable or there is a syntax error in the first 5 lines.

b. If there is a syntax error in the first 5 lines, then there is a missing semicolon or a variable name is misspelled.

c. There is not a missing semicolon.

d. There is not a misspelled variable name.

Let P = there is an undeclared variable

Let Q = there is a syntax error in the first 5 lines

Let R = there is a missing semicolon

Let S = there is a misspelled variable name.

→ a : $P \vee Q$

b : $Q \rightarrow R \vee S$

c : $\sim R$

d : $\sim S$

$\therefore$ P (undeclared variable)

* By c and d (elimination), we see that we don't have a syntax error (Q).

All we have left is P.

Ch. 2 Sect. 3 Prob. 42

Use the valid argument forms to deduce the conclusion from the premises, giving a reason for each step. Assume all variables are statement variables.

a. $p \vee q$

b. $q \to r$

c. $p \wedge s \to t$

d. $\sim r$

e. $\sim q \to u \wedge s$

f. $\therefore t$

① $q \to r$ by premise b
$\sim r$ by premise d
$\therefore \sim q$ by modus tollens

② $\sim q \to u \wedge s$ by premise e
$\sim q$ by ①
$\therefore$ $u \wedge s$ by modus ponens

③ $u \wedge s$ by ②
$\therefore$ u by specialization
$\therefore$ s by specialization

④ $p \vee q$ by premise a.
$\sim q$ by ①
$\therefore$ p by elimination

⑤ p by ④
s by ③
$\therefore$ $p \wedge s$ by conjunction

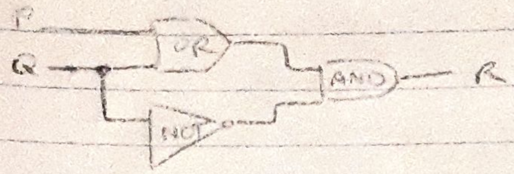
⑥ $p \wedge s \to t$ by premise c
$p \wedge s$ by ⑤

Conclusion → $\therefore$ t by modus ponens

Ch. 2 Sect. 4 Prob. 6

Write an input/output table for the circuit.

Exercise 2:

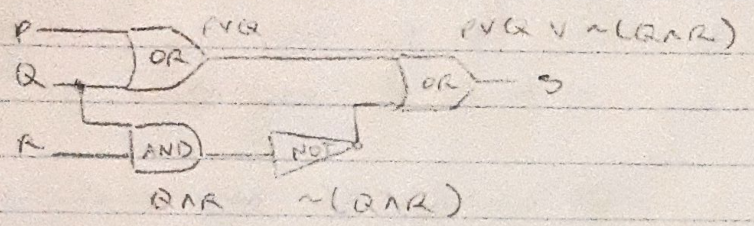


P	Q	$P \vee Q$	$\sim Q$	$P \vee Q \wedge \sim Q$
1	1	1	0	0
1	0	1	1	1
0	1	1	0	0
0	0	0	1	0

Ch. 2 Sect. 4 Prob. 12

Find the Boolean expression that corresponds to the circuit.

Exercise 4:



① P and Q go through OR-gate: $P \vee Q$

② Q and R go through AND-gate: $Q \wedge R$

③ Q and R go through NOT-gate: $\sim(Q \wedge R)$

④ ① and ③ go through OR-gate:

$S = ① \vee ③ = (P \vee Q) \vee \sim(Q \wedge R)$

Ch. 2 Sect. 4 Prob. 18

Construct a boolean expression having the given table as its truth table and a circuit.

	P	Q	R	S
①	1	1	1	0
②	1	1	0	1
③	1	0	1	0
④	1	0	0	0
⑤	0	1	1	1
⑥	0	1	0	0
⑦	0	0	1	0
⑧	0	0	0	0

① Identify rows w/ outputs of 1.

→ Rows ② and ⑤

② Construct an AND statement that produces a 1 for the exact combination of input values for each.

For row ②:

$P = 1,\ Q = 1,\ R = 0$

→ $P \wedge Q \wedge \sim R = 1$.

For row ⑤:

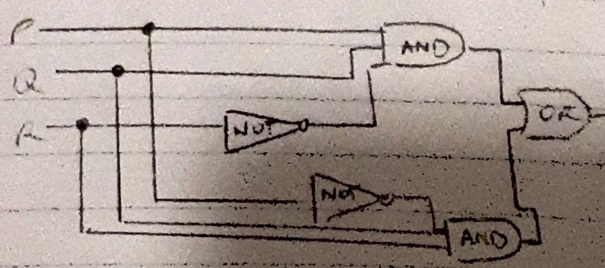
$P = 0,\ Q = 1,\ R = 1$

∴ → $\sim P \wedge Q \wedge R = 1$.

* Join these 2 expressions using an OR statement we end up with:

$(P \wedge Q \wedge \sim R) \vee (\sim P \wedge Q \wedge R)$

* Circuit for the boolean expression.



Ch. 2 Sect. 4 Prob. 21

The lights in a classroom are controlled by 2 switches: one at the back and one at the front of the room. Moving either switch to the opposite position turns the lights off if they are on or on if they are off. Assume the lights have been installed so that when both switches are in the down position, the lights are off. Design a circuit to control the switches.

① Let's create an input/output table.

0 = down and 1 = up

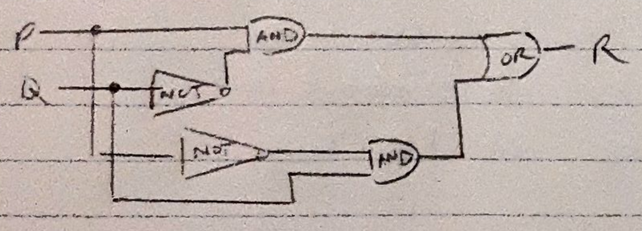
P = 1st switch, Q = 2nd switch, R = output

	P	Q	R
①	1	1	0
②	1	0	1
③	0	1	1
④	0	0	0

- The light turns on only when P and Q are in opposite positions.

From ② From ③

Boolean Expression: $(P \wedge \sim Q) \vee (\sim P \wedge Q)$



Ch. 2 Sect. 4 Prob. 30

For the given boolean expression representing a circuit, there is an equivalent circuit w/ at most 2 logic gates. Find such a circuit.

$(P \wedge Q) \vee (\sim P \wedge Q) \vee (\sim P \wedge \sim Q)$

$\equiv (P \wedge Q) \vee ((\sim P \wedge Q) \vee (\sim P \wedge \sim Q))$

by associative law.

$\equiv (P \wedge Q) \vee (\sim P \wedge (Q \vee \sim Q))$

by distributive law.

$\equiv (P \wedge Q) \vee (\sim P \wedge t)$

by negation law.

$\equiv (P \wedge Q) \vee \sim P$

by identity law.

$\equiv \sim P \vee (P \wedge Q)$

by commutative law.

$\equiv (\sim P \vee P) \wedge (\sim P \vee Q)$

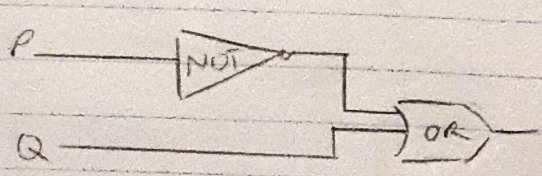
by distributive law.

$\equiv (P \vee \sim P) \wedge (\sim P \vee Q)$ by commutative law.

$\equiv t \wedge (\sim P \vee Q)$ by negation law.

$\equiv (\sim P \vee Q) \wedge t$ by commutative law.

$\equiv \sim P \vee Q$ by identity law.



(Equivalent Circuit)

Ch. 2 Sect. 5 Prob. 6

Represent the decimal integer in binary notation.

$$1424 = 1024 + 256 + 128 + 16$$

$$2^{10} + 2^{8} + 2^{7} + 2^{4}$$

=	1	0	1	1	0	0	1	0	0	0	0
	1024	512	256	128	64	32	16	8	4	2	1

$$1424_{10} = 10110010000$$

Ch. 2 Sect. 5 Prob. 12

Represent the integers in decimal notation

$1011011_2 \rightarrow ?_{10}$

1	0	1	1	0	1	1	$= 64+16+8+2+1 = 91_{10}$
64	32	16	8	4	2	1	$2^6+2^4+2^3+2^1+2^0 = 91$

$\Rightarrow 1011011_2 = 91_{10}$

Ch. 2 Sect. 5 Prob. 18

Perform the arithmetic using binary notation.

$$
\begin{array}{r}
11010_2 \\
-\ 1101_2 \\
\hline
\end{array}
$$

$\rightarrow 2 + 8 + 16 = 26_{10}$

$\rightarrow 1 + 4 + 8 = 13_{10}$

$$
\begin{array}{r}
26 \\
-\ 13 \\
\hline
13_{10}
\end{array}
$$

$$
\begin{array}{r}
1 \\
0\ 0\ 1\ 0\ 1 \\
\cancel{1}\ \cancel{1}\ 0\ \cancel{1}\ 0 \\
-\ \ 1\ 1\ 0\ 1 \\
\hline
1\ 1\ 0\ 1
\end{array}
$$

$1101 = 1 + 4 + 8 = 13_{10}$ ✓

Answer: 1101

To borrow from another column:

$$
\begin{array}{r}
0\ 1 \\
\cancel{1}\ 0_2 \\
-\ \ 1 \\
\hline
1_2
\end{array}
$$

- we borrow a 1 from the next column.
- Now, we have 10_2 in the first column.

$\rightarrow$ 2 - 1 = 1 (which is our result)

Ch. 2 Sect. 5 Prob. 24

Find the 8-bit 2's complement for the integer.

67_{10}

For the 8-bit 2's complement,
we use : $[(2^n - 1) - a] + 1$
- a → our integer
- n → bit length

$\Rightarrow [(2^8 - 1) - 67] + 1 = [255 - 67] + 1 = 189$

$189 = 128 + 32 + 16 + 8 + 4 + 1$
$\quad 2^7 + 2^5 + 2^4 + 2^3 + 2^2 + 2^0$

$189_{10} =$

1	0	1	1	1	1	0	1
128	64	32	16	8	4	2	1

The 8-bit 2's complement of $67_{10} = 10111101_2$

Ch. 2 Sect. [illegible] Prob. 30

Find the decimal representation for the integer w/ the given 8-bit representation.

$10111010_2 = ?_{10}$

* Because the leading bit is a 1, this is an 8-bit representation of a negative integer.

① Find the equivalent positive integer by taking the 2's complement.

- flip the bits: 10111010_2
  $\rightarrow 01000101_2$
- add 1 to the right-most bit:

$$
\begin{array}{r}
01000101_2 \\
+ \quad 1_2 \\
\hline
01000110_2
\end{array}
$$

② Convert the binary number to an integer.

$01000110_2 = 2 + 4 + 64 = 70_{10}$

128 64 32 16 8 4 2 1

③ Throw on a negative sign.

$10111010_2 = -70_{10}$

Ch. 2 Sect. 5 Prob. 36

Use 8-bit representations to compute the sums.

$123 + (-94)$

① Find 2's complement of 94.

$94 = 64 + 16 + 8 + 4 + 2 = 01011110_2$

64 16 8 4 2 1

→ flip the bits: 01011110_2

$\rightarrow 10100001_2$

→ add 1 to the r.m. bit:

$$
\begin{array}{r}
10100001_2 \\
+ \quad 1_2 \\
\hline
10100010_2
\end{array}
$$

$-94 = 10100010_2$

② Find binary representation of 123

$123 = 64 + 32 + 16 + 8 + 2 + 1 = 01111011_2$

128 64 32 16 8 4 2 1

③ $123 + (-94) =$

$$
\begin{array}{r}
1\,1 \quad\quad 1 \quad \\
01111011_2 \\
+ 10100010 \\
\hline
\cancel{1}\ 00011101_2
\end{array}
= 1 + 4 + 8 + 16 = 29_{10}
$$

Ch. 2 Sect. 5 Prob. 42

Convert the integers from hexadecimal to binary.

B 5 3 D F 8

1011 0101 0011 1101 1111 1000

$\Rightarrow$ 10110101 0011 1101 1111 1000_2

B = 11 = 1011

5 = 5 = 0101 * Juxtapose all our results.

3 = 3 = 0011

D = 13 = 1101

F = 15 = 1111

8 = 8 = 1000