

## CHAPTER TWO

### Section 2.1E

1.a. Both Bob jogs regularly and Carol jogs regularly.

$B \& C$

c. Either Bob jogs regularly or Carol jogs regularly.

$B \vee C$

e. It is not the case that either Bob jogs regularly or Carol jogs regularly.

$\sim (B \vee C)$

[or]

Both it is not the case that Bob jogs regularly and it is not the case that Carol jogs regularly.

$\sim B \& \sim C$

g. If it is not the case that Carol jogs regularly then it is not the case that Bob jogs regularly.

$\sim C \supset \sim B$

i. Both (either Bob jogs regularly or Albert jogs regularly) and it is not the case that (both Bob jogs regularly and Albert jogs regularly).

$(B \vee A) \& \sim (B \& A)$

k. Both it is not the case that (either Carol jogs regularly or Bob jogs regularly) and it is not the case that Albert jogs regularly.

$\sim (C \vee B) \& \sim A$

m. Either Albert jogs regularly or it is not the case that Albert jogs regularly.

$A \vee \sim A$

2.a. Albert jogs regularly and so does Bob.

c. Either Albert or Carol jogs regularly.

e. Neither Albert nor Carol jogs regularly.

g. Bob jogs regularly and so does either Albert or Carol.

i. Albert, Carol, and Bob jog regularly.

k. Either Bob or Carol jogs regularly, or neither of them jogs regularly.

3. c and k are true; and a, e, g, and i are false.

CHAPTER THREE

Section 3.1E

1.a.  $2^1 = 2$

c.  $2^2 = 4$

2.a.  $\downarrow$

E	$\sim \sim (E \ \& \ \sim E)$
T	F T T F F T
F	F T F F T F

c.  $\downarrow$

A	J	$A \equiv [J \equiv (A \equiv J)]$
T	T	T T T T T T T
T	F	T T F T T F F
F	T	F T T F F F T
F	F	F T F F F T F

e.  $\downarrow$

A	H	J	$[\sim A \vee (H \supset J)] \supset (A \vee J)$
T	T	T	F T T T T T T T T T
T	T	F	F T F T F F T T T F
T	F	T	F T T F T T T T T T
T	F	F	F T T F T F T T T T F
F	T	T	T F T T T T T T F T T
F	T	F	T F T T F F F F F F
F	F	T	T F T F T T T F T T
F	F	F	T F T F T F F F F F F

g.  $\downarrow$

A	B	$\sim (A \vee B) \supset (\sim A \vee \sim B)$
T	T	F T T T T F T F F T
T	F	F T T F T F T T F
F	T	F F T T T T F T F T
F	F	T F F F T T F T T F

i.  $\downarrow$

B	E	H	$\sim (E \ \& \ [H \supset (B \ \& \ E)])$
T	T	T	F T T T T T T T
T	T	F	F T T F T T T T
T	F	T	T F F T F T F F
T	F	F	T F F F T T F F
F	T	T	T T F T F F F T
F	T	F	F T T F T F F T
F	F	T	T F F T F F F F
F	F	F	T F F F T F F F

k.

D	E	F	$\downarrow$												
$\sim [D \ \& \ (E \ \vee \ F)]$			$\equiv \ [\sim D \ \& \ (E \ \& \ F)]$												
T	T	T	F	T	T	T	T	T	T	F	T	F	T	T	T
T	T	F	F	T	T	T	T	F	T	F	T	F	F	T	F
T	F	T	F	T	T	F	T	T	T	F	T	F	F	F	T
T	F	F	T	T	F	F	F	F	F	F	T	F	F	F	F
F	T	T	T	F	F	T	T	T	T	T	T	F	T	T	T
F	T	F	T	F	F	T	T	F	F	F	T	F	F	T	F
F	F	T	T	F	F	F	T	T	F	F	T	F	F	F	T
F	F	F	T	F	F	F	F	F	F	F	T	F	F	F	F

m.

A	H	J	$\downarrow$												
$(A \ \vee \ (\sim A \ \& \ (H \ \supset \ J)))$			$\supset \ (J \ \supset \ H)$												
T	T	T	T	T	F	T	F	T	T	T	T	T	T	T	T
T	T	F	T	T	F	T	F	T	F	F	T	F	T	T	T
T	F	T	T	T	F	T	F	F	T	T	F	T	F	F	F
T	F	F	T	T	F	T	F	F	T	F	T	F	T	F	F
F	T	T	F	T	T	F	T	T	T	T	T	T	T	T	T
F	T	F	F	F	T	F	F	T	F	F	T	F	T	T	T
F	F	T	F	T	T	F	T	T	F	T	T	F	T	F	F
F	F	F	F	T	T	F	T	T	F	T	F	T	F	T	F

3.a.

A	B	C	$\downarrow$								
$\sim [\sim A \ \vee \ (\sim C \ \vee \ \sim B)]$											
F	T	T	F	T	F	T	F	T	F	F	T

c.

A	B	C	$\downarrow$						
$(A \ \supset \ B) \ \vee \ (B \ \supset \ C)$									
F	T	T	F	T	T	T	T	T	T

e.

A	B	C	$\downarrow$						
$(A \ \equiv \ B) \ \vee \ (B \ \equiv \ C)$									
F	T	T	F	F	T	T	T	T	T

g.

A	B	C	$\downarrow$									
$\sim [B \ \supset \ (A \ \vee \ C)] \ \& \ \sim \sim B$												
F	T	T	F	T	T	F	T	T	F	T	F	T

i.

A	B	C	$\downarrow$												
$\sim [\sim (A \ \equiv \ \sim B) \ \equiv \ \sim A] \ \equiv \ (B \ \vee \ C)$															
F	T	T	T	F	F	T	F	T	F	T	F	T	T	T	T

4.a.

$$\downarrow$$

D	F	G	F	$\vee$	(G	$\vee$	D)
T	T	T	T	T	T	T	T
T	T	F	T	T	F	T	T
T	F	T	F	T	T	T	T
T	F	F	F	T	F	T	T
F	T	T	T	T	T	T	F
F	T	F	T	T	F	F	F
F	F	T	F	T	T	T	F
F	F	F	F	F	F	F	F

c.

$$\downarrow$$

D	F	G	[F $\vee$ (G $\vee$ D)]	&	( $\sim$ (F $\vee$ G) $\vee$ [ $\sim$ (F $\vee$ D) $\vee$ $\sim$ (G $\vee$ D)])																											
T	T	T	T	T	T	T	T	F	F	T	T	T	F	F	T	T	T	F	F	T	T	T	F	F	T	T	T					
T	T	F	T	T	F	T	T	F	F	T	T	F	F	F	T	T	T	F	F	T	T	T	F	F	F	T	T	F	T	T		
T	F	T	F	T	T	T	F	F	F	T	T	F	F	F	T	T	F	F	F	T	T	T	F	F	F	T	T	T	T	T		
T	F	F	F	T	F	T	T	T	T	F	F	F	F	T	F	F	T	T	F	F	F	T	T	F	F	F	T	T	F	T	T	
F	T	T	T	T	T	F	F	F	T	T	T	T	F	F	T	T	F	F	T	T	F	F	F	F	F	T	T	F	T	T	F	
F	T	F	T	T	F	F	F	T	F	T	T	F	T	F	T	T	F	T	F	T	T	F	T	T	F	T	T	F	F	F	F	
F	F	T	F	T	T	F	T	F	F	T	T	F	T	T	F	F	T	T	F	F	F	T	F	F	F	T	F	T	T	F	T	F
F	F	F	F	F	F	F	F	T	F	F	F	T	T	F	F	F	T	T	F	F	F	T	T	F	F	T	T	F	F	F	F	

e.

$$\downarrow$$

D	F	G	(F & G)	$\vee$	[(F & D) $\vee$ (G & D)]							
T	T	T	T	T	T	T	T	T	T	T	T	
T	T	F	T	F	F	T	T	T	T	F	F	T
T	F	T	F	F	T	T	F	F	T	T	T	T
T	F	F	F	F	F	F	F	T	F	F	F	T
F	T	T	T	T	T	T	F	F	F	T	F	F
F	T	F	T	F	F	F	T	F	F	F	F	F
F	F	T	F	F	T	F	F	F	F	T	F	F
F	F	F	F	F	F	F	F	F	F	F	F	F

g.

$$\downarrow$$

D	F	G	[(F & G) & $\sim$ D]	$\vee$	[(F & D) & $\sim$ G]	$\vee$	[(G & D) & $\sim$ F]																												
T	T	T	T	T	T	F	F	T	F	T	T	T	F	F	T	F	F	T	F	F	T	F	F	T	F	F	T	F	F	T	F	F	T		
T	T	F	T	F	F	F	F	T	T	T	T	T	F	T	F	F	F	T	F	F	T	F	F	T	F	F	T	F	F	T	F	F	T		
T	F	T	F	F	T	F	F	T	F	F	T	F	F	T	T	T	T	T	F	F	T	F	F	T	F	F	T	F	F	T	F	F	T		
T	F	F	F	F	F	F	F	T	F	F	T	F	F	F	F	F	T	F	F	F	F	T	F	F	T	F	F	T	F	F	T	F	F	T	
F	T	T	T	T	T	T	F	T	T	F	T	F	T	T	F	T	F	F	F	T	F	F	T	F	F	T	F	F	T	F	F	T	F	F	T
F	T	F	T	F	F	F	T	F	F	T	F	F	F	T	F	F	F	F	T	F	F	F	T	F	F	T	F	F	T	F	F	T	F	F	T
F	F	T	F	F	T	F	F	F	F	F	F	F	F	T	F	F	F	F	T	F	F	F	T	F	F	T	F	F	T	F	F	T	F	F	T
F	F	F	F	F	F	F	T	F	F	F	F	F	F	T	F	F	F	F	T	F	F	F	T	F	F	T	F	F	T	F	F	T	F	F	T

5.a.

D	F	G		[F $\vee$ (G $\vee$ D)]	$\supset$	[F & (G & D)]
T	T	T		T	T	T
T	T	F		T	F	F
T	F	T		F	F	T
T	F	F		F	F	F
F	T	T		T	T	F
F	T	F		T	F	F
F	F	T		F	F	T
F	F	F		F	F	F

c.

D	F	G	S		S $\supset$ [G $\supset$ $\sim$ (F $\vee$ D)]
T	T	T	T		T
T	T	T	F		F
T	T	F	T		T
T	T	F	F		F
T	F	T	T		T
T	F	T	F		F
T	F	F	T		T
T	F	F	F		F
F	T	T	T		T
F	T	T	F		F
F	T	F	T		T
F	T	F	F		F
F	F	T	T		T
F	F	T	F		F
F	F	F	T		T
F	F	F	F		F

e.

D	P	S		D $\equiv$ (P & S)
T	T	T		T
T	T	F		F
T	F	T		F
T	F	F		F
F	T	T		T
F	T	F		F
F	F	T		F
F	F	F		F

### Section 3.5E

#### 1.a. Truth-functionally valid

A	H	J	$\downarrow$ A $\supset$ (H & J)	J $\equiv$ H	$\downarrow$ $\sim$ J	$\downarrow$ $\sim$ A
T	T	T	T	T	F	F
T	T	F	F	F	F	F
T	F	T	F	F	F	F
T	F	F	F	F	F	F
F	T	T	T	T	F	F
F	T	F	F	F	F	F
F	F	T	F	F	F	F
F	F	F	F	F	F	F

#### c. Truth-functionally valid

A	D	G	$\downarrow$ (D $\equiv$ $\sim$ G) & G	(G $\vee$ [(A $\supset$ D) & A])	$\downarrow$ $\supset$ $\sim$ D	$\downarrow$ G $\supset$ $\sim$ D
T	T	T	F	T	F	F
T	T	F	T	F	F	F
T	F	T	F	T	T	T
T	F	F	F	F	T	F
F	T	T	F	T	F	F
F	T	F	T	F	F	F
F	F	T	F	T	T	T
F	F	F	F	F	T	F

e. Truth-functionally valid

C	D	E	$\downarrow$ (C $\supset$ D) $\supset$ (D $\supset$ E)				$\downarrow$ D	$\downarrow$ C $\supset$ E		
T	T	T	T	T	T	T	T	T	T	T
T	T	F	T	T	F	F	T	T	F	F
T	F	T	T	F	F	T	F	T	T	T
T	F	F	T	F	F	T	F	T	F	F
F	T	T	F	T	T	T	T	F	T	T
F	T	F	F	T	F	T	F	F	T	F
F	F	T	F	T	F	T	T	F	T	T
F	F	F	F	T	F	T	F	F	T	F

g. Truth-functionally valid

G	H	$\downarrow$ (G $\equiv$ H) $\vee$ ( $\sim$ G $\equiv$ H)				$\downarrow$ ( $\sim$ G $\equiv$ $\sim$ H) $\vee$ $\sim$ (G $\equiv$ H)			
T	T	T	T	T	F	T	F	T	T
T	F	T	F	F	T	F	T	T	F
F	T	F	F	T	T	F	T	T	T
F	F	F	T	F	T	F	T	F	F

i. Truth-functionally invalid

F	G	$\downarrow$ $\sim\sim$ F $\supset$ $\sim\sim$ G			$\downarrow$ $\sim$ G $\supset$ $\sim$ F			$\downarrow$ G $\supset$ F		
T	T	T	F	T	F	T	T	T	T	T
T	F	T	F	F	T	F	F	T	T	T
F	T	F	T	T	F	T	T	F	F	F
F	F	F	T	F	T	F	T	F	F	F

2.a. Truth-functionally valid

J	M	$\downarrow$ (J $\vee$ M) $\supset$ $\sim$ (J & M)					$\downarrow$ M $\equiv$ (M $\supset$ J)			$\downarrow$ M $\supset$ J		
T	T	T	T	T	F	F	T	T	T	T	T	T
T	F	T	T	F	T	T	T	F	F	F	T	T
F	T	F	T	T	T	T	F	F	T	F	F	F
F	F	F	F	F	T	T	F	F	F	T	F	F

c. Truth-functionally valid

		↓					↓				↓		
A	B	$A \supset \sim A$			$(B \supset A) \supset B$				$A \equiv \sim B$				
T	T	T	F	F	T	T	T	T	T	T	F	F	F
T	F	T	F	F	F	T	T	F	F	T	T	T	F
F	T	F	T	T	T	F	F	T	T	F	T	F	T
F	F	F	T	T	F	T	F	F	F	F	F	F	T

e. Truth-functionally invalid

			↓							↓				↓		
A	B	C	$A \& \sim [(B \& C) \equiv (C \supset A)]$						$B \supset \sim B$			$\sim C \supset C$				
T	F	F	T	T	T	F	F	F	F	F	T	T	F	T	F	F

3.a. Truth-functionally valid

		↓
B	C	$(B \& C) \supset (B \vee C)$
T	T	T
T	F	T
F	T	T
F	F	T

c. Truth-functionally invalid

		↓
J	T	$[(J \supset T) \supset J] \& [(T \supset J) \supset T] \supset (\sim J \vee \sim T)$
T	T	F

e. Truth-functionally invalid

			↓
B	C	D	$[(B \& C) \& (B \vee D)] \supset D$
T	T	F	F

4.a. Truth-functionally invalid

S: 'Stern' means the same as 'star'.

N: 'Nacht' means the same as 'day'.

		↓	↓	↓
N	S	$N \supset S$	$\sim N$	$\sim S$
T	T	T	F	F
T	F	F	F	F
F	T	T	T	F
F	F	F	T	F