HW Solutions

No. 1.1

Date 1

Problem	Ans		Reason
1	(a)	No	$t \in S$ and $f \notin T$
	(b)	No	$b \in R$ and $b \notin S$
	(c)	Yes	$b \in R$ and $b \in T$
2	(a)	Yes	
	(b)	No	S not in T
	(c)	Yes	$c \in S$ and $c \in T$
3	$(R \cup S) \cap T = \{a, b, c \}$		$R \cup S = \{a, b, c, f\}$
4	$(E \cup F) \cap G' = \{t, z\}$		

U	1	2	t	u	v	x	y	z
E		•	•				•	
F	•	•		•			•	•
G	•	•		•			•	
$E \cup F$	•	•	•	•			•	•
G'			•		•	•		•
$(E \cup F) \cap G'$			•					•

5

B	C
p	qr
q	pr
r	qp
pq	r
pr	q
qr	p

Problem	Ans	Reason

6

(a) $A' = \{1, 3, 5\}$

(b) $A' \cap B' = \{3\}$

(c) $A \cup B = \{1, 2, 4, 5\}$

(d) $(A \cup B)' = \{3\}$

U	1	2	3	4	5
A		•		•	
B	•				•
A'	•		•		•
B'		•	•	•	
$A' \cap B'$			•		
$A \cup B$	•	•		•	•
$(A \cup B)'$			•		

7

(a) T

(b) F

(c) T

(d) F

(e) F

(f) T

8

(a) Y

(b) N Take $T \neq \phi$.

(c) N Take $R \neq \phi$, $S = \phi$, $T = \phi$

(d) N Take $U \neq \phi$, $R =$ [illegible], $S = \phi$

9

(a) $E' = \{u, v, x, 1, 3\}$

(b) $F \cup G' = \{u, v, x, y, z, 2, 3\}$

(c) $(E \cup F) \cap G' = \{u, z\}$

U	u	v	w	x	y	z	1	2	3
E			•		•	•		•	
F	•				•	•		•	•
G			•		•		•	•	•
E'	•	•		•			•		•
G'	•	•		•		•			
$F \cup G'$	•	•		•	•	•		•	•
$E \cup F$	•		•		•	•		•	•
$(E \cup F) \cap G'$	•					•			

Problem	Ans	Reason

10

(a) $A \cup B = \{4, z, 1, 2\}$

(b) $B \cap C = \phi$

(c) $A' = \{x, 1, 3\}$

(d) $(A \cup B) \cap (B \cup C) = \{4, 1, 2\}$

(e) $(B \cap A') \cap C' = \{1\}$

U	x	4	z	1	2	3
A		•	•		•	
B		•		•	•	
C	•					•
A'	•			•		•
$A \cup B$		•	•	•	•	
$B \cup C$	•	•		•	•	•
$(A \cup B) \cap (B \cup C)$		•		•	•	
$B \cap C$						
$B \cap A'$				•		
$(B \cap A') \cap C'$				•		

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(a) $A \cup B = \{a, b, c, 2, 3\}$

(b) $B \cap C = \{2, 3\}$

(c) $(A \cup B) \cap (B \cup C) = \{a, 2, 3\}$

(d) $A' = \{1, 2, 3\}$

(e) $A \cap B' = \{b, c\}$

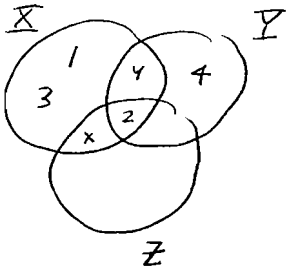
(f) $A \cup C' = \{a, b, c\}$

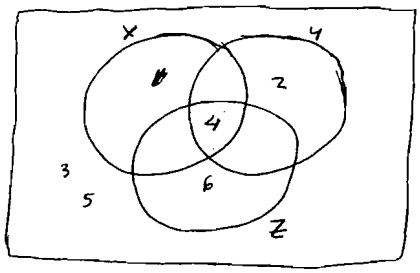
U	a	b	c	1	2	3
A	•	•	•			
B	•				•	•
C				•	•	•
$A \cup B$	•	•	•		•	•
$B \cap C$					•	•
$B \cup C$	•			•	•	•
$(A \cup B) \cap (B \cup C)$	•				•	•
A'				•	•	•
B'		•	•	•		
$A \cap B'$		•	•			
C'	•	•	•			
$A \cup C'$	•	•	•			

No.

Date 4

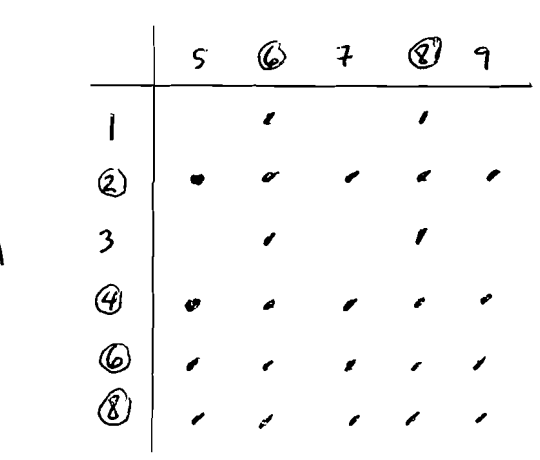
Problem	Ans	Reason
12	(a) T	
	(b) T	
	(c) T	
	(d) F	
	(e) T	
13	(a) $A \cap B = \{ x :$	x works for GM and owns a GM car $\}$
	(b) $B \cap A' = \{ x :$	x works for GM and does not own a GM car $\}$
	(c) $(A \cup B) \cap D = \{ x :$	x owns stock in GM, and either owns a GM car or works for GM $\}$
	(d) $C \cap A = \{ x :$	x owns a GM car and is the president of GM $\}$
14	$\{a, b\} \subset X \cup Y$	Always true
	$\{a, b\} \subset X \cap Y$	Not always true
15	(a) No	take $U \neq \phi$, $B \neq \phi$, $A = \phi$
	(b) Yes	
	(c) Yes	if $x \notin A$ and $x \notin B$ then $x \notin A \cap B$
	(d) No	take $U \neq \phi$, $A = U$, $B = \phi$
16	(a) yes	
	(b) No	take $U \neq \phi$, $A = \phi$, $B = U$, $C = \phi$, $D = U$
17	(a) yes	
	(b) No	
	(c) yes	

Problem	Ans	Reason
18	(a) Require $B \subset A$, an example is $B = \phi$, $A = U$	
	(b) Require $A \subset B$, an example is $A = \phi$, $B = U$	
	(c) Require $A \cap B = \phi$, an example is $A = \phi$, $B = \phi$	
	(d) Require $A = B$, an example is $A = \phi$, $B = \phi$	
19	$A = X \cap Y$ $B = X \cap Z'$ $C = Y \cup Z$	
20	$\{x\} = Z \cap Y'$	
21	(a) ϕ, $\{x\}$	
	(b) ϕ, $\{x\}$, $\{y\}$, $\{x, y\}$	
	(c) ϕ, $\{x\}$, $\{y\}$, $\{z\}$, $\{x, y\}$, $\{x, z\}$, $\{y, z\}$, $\{x, y, z\}$	
22	(a) 2	
	(b) $2^2 = 4$	
	(c) $2^3 = 8$	
	(d) $2^4 = 16$	
	# subsets of an n-element set is 2^n	
23	$X = \{b, c, 2, 4, 6\}$, $Y = \{b, 2, 4\}$, $Z = \{b, 4, 6\}$	
	$X = \{b, c, 2, 4\}$, $Y = \{b, 2, 4, 6\}$ $Z = \{b, 4, 6\}$	

Problem	Ans	Reason
24	$B \times A$ = $\{ar, aa, at, tr, ta, tt, ur, us, ut\}$	
25	$A \times B$ = $\{aa, ab, ad, ba, bb, bd, ca, cb, cd\}$ $B \times A$ = $\{aa, ab, ac, ba, bb, bc, da, db, dc\}$ $(A \times B) \cap (B \times A) = \{aa, ab, ba, bb\}$	
26	$X = \{1, 4\}$, $Y = \{2, 4\}$, $Z = \{4, 6\}$ 	
27	$A = \{a, b\}$ $B = \{1, 2, 3\}$	
28	(a) T	both sides equal $\{1,2\} \times \{1,2\}$
	(b) T	
	(c) F	$33 \in A \times A$ but $33 \notin (A \times B) \cap (B \times A)$
	(d) F	$33 \in A \times A$ but $33 \notin (A \times B) \cup (B \times A)$

No.

Date 7

Problem	Ans	Reason
29	(a) T (b) T (c) F (d) F	$A = \{(-1,1), (0,0), (1,1)\}$ $B = \{(-2,4), (-1,1), (0,0), (1,1), (2,4)\}$
30	$A \times A = \{(x,y) : x \in A, y \in A\}$ $B \times B = \{(x,y) : x \in B, y \in B\}$ $A \subseteq B$ so $A \times A \subset B \times B$ In all cases if $A \subset B$ then $A \times A \subset B \times B$	
31	$C \times A =$ $\{d1, d2, e1, e2\}$	$A = \{1, 2\}$ $B = \{a, b, c\}$
32	$n(W) = 24$	 $5 \times 4 + 4 = 24$
33	23	$A \times B$ has 12 elements $B \times A$ has 12 elements $A \times B$ and $B \times A$ have one element in common $12 + 12 - 1 = 23$