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Quiz 2-A

MAD 2104

Summer A 2015

1. (6 pts) For each of the following, circle the correct answer. Only one answer is correct. No proof or justification necessary, but a Venn diagram may help you.

(a) For any sets S, T, if $S \subseteq T$ then:

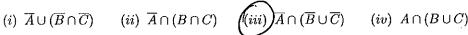
$$(i)$$
 $\overline{T} \subseteq \overline{S}$

(iii)
$$T - S = \emptyset$$

(ii)
$$T \subseteq S \cap T$$
 (iii) $T - S = \emptyset$ (iv) $S \cap T = S \cup T$

(b) According to DeMorgan's laws $\overline{A \cup (B \cap C)} =$

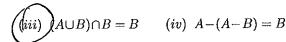
(i)
$$\overline{A} \cup (\overline{B} \cap \overline{C})$$



(c) Which of the following is true for all sets A and B?

$$(i) \ A \cup \overline{B} = \overline{A \cap B}$$

(ii) $A \cup \overline{B} = (A \cap B) \cup B$



2. (7 pts) The symmetric difference of two sets A, B is denoted by $A \oplus B$ and is defined sometimes by $(A-B)\cup (B-A)$ and sometimes by $(A\cup B)-(A\cap B)$.

- (a) (6 pts) Show that for any sets A and B, $(A B) \cup (B A) = (A \cup B) (A \cap B)$.
- (b) (1 pts) To what logical connector does the set operation $A \oplus B$ correspond to?

(a) x e(A-B)U(B-A) => x EA B 4 x eB A =>

(TEANTEB) v (YEBNYEA) (YEBNYEA)) ~ (YEBNYEA))

(-> [reAvreb] ~ [7 (xeB ~ xeA)] (-> xeAUB ~ 7 (xeA)B)

DeMorgan

←> re AUB ~ re ANB ←> re (AUB) ~ (ANB)

Thus (A-B) U (D-A) = (AUB) - (AAB)

Solution 2 using set identities

 $(A - B) \cup (B - A) = (A \cap B) \cup (B \cap A) = (A \cup (B \cap A)) \cap (B \cup (B \cap A))$ = [(AUB) n(AUA)] n (BUB) n (BUA)] = [(AUB) n U] n [U n BNA

= (AUB) N ANB = (AUB) - (ANB)

- 3. (8 pts) For each of the following, circle all the true statements. More than one, or none, of the answers could be true. No proof or justification necessary.
- (a) Let $A = \{1, 2, 3, 4\}$ and let $\mathcal{P}(A)$ be the power set of A. From the statements below, circle the ones which are true:

$$(i) \ \ 2 \in \mathcal{P}(A) \qquad (ii) \ \ \{1,3\} \subseteq \mathcal{P}(A) \qquad (iii) \ \ \{1,3\} \in \mathcal{P}(A) \qquad (iv) \ \ \{2\},\{4\}\} \subseteq \mathcal{P}(A)$$

- (b) On the set of all people, let \mathcal{R} be the relation given by $(a,b) \in \mathcal{R}$ if and only if a and b have the same birthday (day and month). From the statements below, circle the ones which are true:
- (i) \mathbb{R} is reflexive (ii) \mathbb{R} is symmetric (iii) \mathbb{R} is anti-symmetric (iv) \mathbb{R} is transitive
 - 4. (6 pts) If possible, give an example of a relation \mathcal{R} on the set $A = \{a, b, c\}$ which is reflexive, anti-symmetric, but not symmetric and not transitive. If not possible, explain why.

Due of the possible examples: R= \((a,a), (b,b), (c,c), (a,b), (b,c)\)

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Quiz 2-B MAD 2104 Summer A 2015

1. (6 pts) For each of the following, circle the correct answer. Only one answer is correct. No proof or justification necessary, but a Venn diagram may help you.

(a) For any sets S, T, if $S \subseteq T$ then:

$$(i) \ \overline{S} \subseteq \overline{T}$$

(ii)
$$S \cap T = 0$$



$$(iv) \ S \cap T = S \cup T$$

(b) According to DeMorgan's laws $\overline{A \cap (B \cup C)} =$

$$(i) \ \ \overline{A} \cap (\overline{B} \cup \overline{C})$$

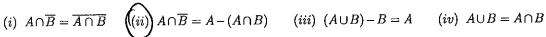
$$(ii) \overline{A} \cup (\overline{B} \cap \overline{C}) \qquad (iii) \ \overline{A} \cup (B \cup C) \qquad (iv) \ A \cup (B \cap C)$$

(iii)
$$\overline{A} \cup (B \cup C$$

(iv)
$$A \cup (B \cap C)$$

(c) Which of the following is true for all sets A and B?

(i)
$$A \cap \overline{B} = \overline{A \cap B}$$



$$(iii) \ (A \cup B) - B = A$$

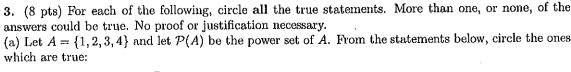
$$(iv) \ A \cup B = A \cap B$$

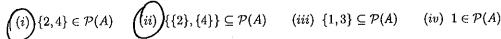
2. (7 pts) The symmetric difference of two sets A, B is denoted by $A \oplus B$ and is defined sometimes by $(A-B)\cup (B-A)$ and sometimes by $(A\cup B)-(A\cap B)$.

(a) (6 pts) Show that for any sets A and B, $(A - B) \cup (B - A) = (A \cup B) - (A \cap B)$.

(b) (1 pts) To what logical connector does the set operation $A \oplus B$ correspond to?

see solution on Quiz 2-A





- (b) On the set of all people, let \mathcal{R} be the relation given by $(a,b) \in \mathcal{R}$ if and only if a and b have the same birthday (day and month). From the statements below, circle the ones which are true:
- (i) \mathcal{R} is reflexive (ii) \mathcal{R} is symmetric (iii) \mathcal{R} is anti-symmetric (iv) \mathcal{R} is transitive
 - 4. (6 pts) If possible, give an example of a relation \mathcal{R} on the set $A = \{a, b, c\}$ which is symmetric, transitive, but not reflexive and not anti-symmetric. If not possible, explain why.

One of the possible examples
$$R = \{(a,b), (b,a), (a,a), (b,b)\}$$