NAME: SID:

Problem 1. (10 points). (a) Define the greatest common divisor of two numbers. (b) Give Euclid's algorithm for computing the greatest common divisor of two numbers. You can present it in pseudo-code or in plan English.

Problem 2. (10 points). You are given three relations $P, Q, R \subseteq \{a, b, c, d\} \times \{a, b, c, d\}$:

P	a	b	c	d
a	Y	N	Y	N
b	N	Y	N	Y
c	Y	N	Y	N
d	N	Y	N	Y

Q	a	b	c	d
a	Y	Y	N	Y
b	N	Y	N	Y
c	N	N	Y	Y
d	N	N	N	Y

R	a	b	c	d
a	Y	N	N	N
b	N	N	N	Y
c	N	N	N	Y
d	N	N	Y	N

For each relation tell (write Y or N) whether it is:

	Reflexive	Transitive	Symmetric	Partial order	Equivalence
P					
Q					
R					

Problem 3. (10 points). For each sentence (a)-(e) below, tell which of the sentences (i)-(iv) is its negation.

(a) **"If X is green, then X is a vegetable."**

(i) "X is not green and X is not a vegetable."
(ii) "X is not green or X is not a vegetable."
(iii) "X is green and X is not a vegetable."
(iv) "If X is green then X is not a vegetable."
(v) None of the above.

(b) "$\forall x\ \exists y : y < x + 10$"

(i) "$\exists x\ \exists y : y > x + 10$."
(ii) "$\forall x\ \exists y : y \geq x + 10$."
(iii) "$\forall y\ \exists x : x + 10 < y$."
(iv) "$\exists x\ \forall y : y > x + 10$."
(v) None of the above.

(c) **"X is a president, and either Y or Z is a vice-president."**

(i) "Either X is not a president, or none of Y and Z is a vice-president."
(ii) "X is not a president, and neither Y nor Z is a vice-president."
(iii) "Either X is not a president, or one of Y and Z is not a vice-president."
(iv) "X is not a president, and one of Y or Z is a vice-president."
(v) None of the above.

(d) **"Some of us can ski but cannot swim."**

(i) "Some of us can swim but cannot ski."
(ii) "All of us either can swim or cannot ski."
(iii) "All of us cannot ski and can swim."
(iv) "Some of us cannot ski but can swim."
(v) None of the above.

(e) **"For any X, if X barks then X is a dog."**

(i) "For any X, if X does not bark then X is a dog."
(ii) "For any X, if X does not bark then X is not a dog."
(iii) "There exists X that barks and is not a dog."
(iv) "There is no X that does not bark and is not a dog."
(v) None of the above.