

MATH 74 HOMEWORK 1
DUE TUESDAY, SEPTEMBER 2ND

- (1) Do Problems 1.3, 1.4, and 1.5 in Eccles.
- (2) Convert the following sentences into the notation of propositional and predicate logic, using the given list of predicates. The first problem is done as an example.

Predicates: $T(x)$ = “ x is tired.” $B(x)$ = “ x goes to bed early.”
 $C(x)$ = “ x is cranky.” $L(x, y)$ = “ x likes y .” $W(x, y)$ = “ x wants y .”
 $E(x, y)$ = “ x eats y .” $R(x, y)$ = “ x rocks y like a hurricane.”

- (a) If Steve is tired, then he goes to bed early.
Solution: $T(\text{Steve}) \Rightarrow B(\text{Steve})$.
- (b) Steve is tired and cranky.
- (c) Steve only goes to bed early if he is tired.
- (d) Steve likes doughnuts and coffee.
- (e) Steve likes either doughnuts or coffee (possibly both!).
- (f) Steve likes either doughnuts or coffee, but not both.
- (g) Steve only likes coffee if he is cranky.
- (h) Steve eats doughnuts whenever he wants doughnuts.
- (i) If Steve eats doughnuts and plums, then Steve is tired and cranky and goes to bed early.
- (j) If Steve eats a doughnut, then it rocks him like a hurricane.
- (3) Convert the following sentences into the notation of propositional and predicate logic, using the given list of predicates. You may use the predicates $=, <, >$. The first problem is done as an example.

Predicates: $E(n)$ = “ n is even.” $P(n)$ = “ n is prime.”

- (a) Every prime number is odd, except for 2.
Solution: $(P(n) \text{ and } (\text{not } n = 2)) \Rightarrow (\text{not } E(n))$.
- (b) The only even prime number is 2.
- (c) The square of any nonzero number is positive. [*Positive* means greater than 0, *not* greater than or equal to 0.]
- (d) The square of any odd number is odd.
- (e) Every positive number is either equal to 1 or greater than 1.

- (4) Let $P(n)$ be the predicate “ n is even” and let $Q(n)$ be the predicate “ n^2 is even.” For which integers n is $P(n) \Rightarrow Q(n)$ true? For which ones is it false? Draw a truth table that illustrates this.
- (5) Let $P(n, m)$ be the statement “If n is greater than m , then n^2 is greater than m^2 .” For which integers n and m is $P(n, m)$ true? For which ones is it false?