

# PHIL 3340 (Symbolic Logic II)

## First Exam - Sample Questions

Curtis Brown

February 25, 2004

### 1 Set Theory

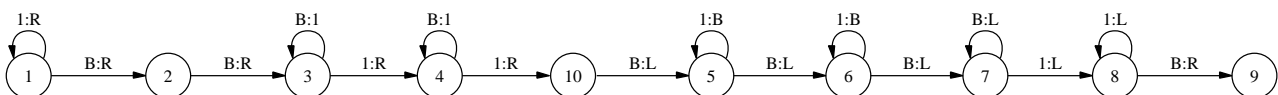
1. Let set  $A = \{1, 2, 3\}$  and let  $B = \{2, 4, 6, 8\}$ . Give a function from  $A$  to  $B$  that is total and one-to-one but not onto.
2. Give a function from  $B$  to  $A$  that is total and onto but not one-to-one.
3. Consider the function  $f = \{(1, 2), (2, 4), (3, 4), (4, 5)\}$ . Give  $f^{-1}$ .

### 2 Enumerability

4. Give an informal proof that the rational numbers are enumerable.
5. Give an informal proof that the real numbers between 0 and 1 (including 0 and excluding 1) are not enumerable.

### 3 Computability

6. Consider the following Turing machine. What function  $f : \mathbb{X}^+ \rightarrow \mathbb{X}^+$  does it compute?



7. Write a Turing machine to compute the function  $f(n) = n + 1$ .

## 4 Recursive Functions

8. Consider the function  $f : \mathbb{Z}^+ \times \mathbb{Z}^+ \rightarrow \mathbb{Z}^+$  defined as follows:  $f(x, y) = |x^2 - 2y|$ . (That is,  $f$  is the absolute value of  $x^2 - 2y$ .) What is  $\text{Mn}[f](2)$ ? How about  $\text{Mn}[f](3)$ ?  $\text{Mn}[f](4)$ ?