Bucknell UNIVERSITY

Theory of Computation
CSCI 341, Fall 2016

Recitation 3
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Exercise 0.11 from Sipser page 27

Exercise 2

Consider the function below. It searches in a binary tree for an element stored at a given `key` in the tree with root `node`.

```
# https://en.wikipedia.org/wiki/Binary_search_tree
def search_recursively(key, node):
    if node is None or node.key == key:
        return node
    elif key < node.key:
        return search_recursively(key, node.left)
    else:  # key > node.key
        return search_recursively(key, node.right)
```

Define a well-founded relation on binary trees that allows to prove by well-founded induction that the function `search_recursively()` terminates.

Exercise 3

Prove that the set of all **finite subsets** of $\mathbb{N}$ is countable. (Hint: find a bijection with $\mathbb{N}$)

Exercise 4

Suppose that we try to prove that the set of all **finite subsets** of $\mathbb{N}$ is uncountable, by an argument exactly parallel to the proof of the uncountability of $2^{\mathbb{N}}$. What goes wrong?