

EECS 343: Theoretical Computer Science, Homework Exercise 7
due Monday, March 16, 2020 before class

Problem 1: Show that if $K(x)$ were computable, we could use the following procedure to create a short description for an incompressible string:

```
function incompressible(n: integer) {  
    for  $x \in \{0,1\}^n$   
        if  $K(x) \geq n$  then output  $x$   
}
```

Problem 2: Show that the class of languages P is closed under union, concatenation, and complement.

Problem 3: (Sipser 7.14) A *permutation* on the set $\{1, \dots, k\}$ is a one-to-one, onto function on this set. When p is a permutation, p^t means the composition of p with itself t times. Let

$$\text{PERM-POWER} = \{\langle p, q, t \rangle \mid p = q^t\}$$

where p and q are permutations on $\{1, \dots, k\}$ and t is an integer represented in binary.

Show that $\text{PERM-POWER} \in P$. (Hint: the obvious algorithm does not have a running time that is polynomial in the size of the input.)