

---

## Complexity Theory

---

*Due date: July 2, 2013 before class!*

### **Problem 1 (10 Points)**

Show that

- (i) **RP** and **BPP** are closed under  $\preceq_m^p$ ,
- (ii) **RP** and **BPP** are closed under union and intersection.

### **Problem 2 (10 Points)**

Show that, if  $\mathcal{NP} \subseteq \mathbf{BPP}$ , then  $\mathbf{RP} = \mathcal{NP}$ .

### **Problem 3 (10 Points)**

Show that **RP** does not change if we replace  $\geq 2/3$  in the definition of **RP** by  $\geq n^{-k}$  or by  $1 - 2^{-n^d}$ .

### **Problem 4 (10 Points)**

Prove that  $\mathbf{ZPP} = \mathbf{RP} \cap \mathbf{coRP}$ .