

## Homework 5

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**1.** Since  $L \leq_m L'$ , we have a poly-time computable function  $f$  s.t.  $\forall x, x \in L'$  iff  $f(x) \in B$ .  
Since  $L \in P$ , we have an (det.) alg  $M$  to solve  $L$ .  
Input  $w \in L$ ,  $M$  says YES;  $w \notin L$ ,  $M$  says NO;  
Construct a poly-time alg  $M'$  to solve  $L'$ ;  
Input  $x$ ;  
Run  $f(x)$  on  $M$ ;  
if  $f(x) \in L$ ,  $M$  says YES on  $f(x)$ ,  $M'$  says YES on  $x$ ;  
if  $f(x) \notin L$ ,  $M$  says NO on  $f(x)$ ,  $M'$  says NO on  $x$ ;  
Then, the result follows ( $L' \in P$ ).

**2.** Since  $L \leq_m L'$ , we have a poly-time computable function  $f$  s.t.  $\forall x, x \in L'$  iff  $f(x) \in L$ .  
On the contrary,  $\forall x, x \notin L', f(x) \notin B$ . In other words,  $\forall x, x \in \overline{L'}, f(x) \in \overline{L}$ . Hence,  $L \leq_m L'$  follows.

- 3.**
- 4.**
- 5.**
- 6. 7.**
- 8.**