**2010 Autumn semester Pattern Information Processing**

# Problems on Topic 3

Prove the following equations on mathematical morphology. Let $X, Y$ be images and $B$ be a structuring element.

1. $X^B = [(X^c)_B]^c$ (Duality between opening and closing)
2. $X \subset Y \Rightarrow X_B \subset Y_B$ (Increasingness of opening)
   (Hint: $B_x \subseteq X \Rightarrow B_x \subset Y$, where $x$ is a vector.)
3. $X_B \subseteq X$ (Antiextensivity of opening)
   (Hint: Show $u+v \in X_B \Rightarrow u+v \in X$, where $u$ and $v$ are vectors, using the relationship $X_B = (X \ominus \check{B}) \oplus B = \{u+v | u \in X \ominus \check{B}, v \in B\}$.)