

## Musterlösungen zum Übungsblatt 10

### 1. (12 Punkte)

a)  $\forall xPx \wedge \forall xQx \vdash \forall x(Px \wedge Qx)$

1. $\forall xPx \wedge \forall xQx$	(A)
2. $\forall xPx$	$\wedge B1; 1$
3. $\forall xQx$	$\wedge B2; 1$
4. $Px$	$\forall B; 2$
5. $Qx$	$\forall B; 3$
6. $Px \wedge Qx$	$\wedge E; 4, 5$
7. $\forall x(Px \wedge Qx)$	$\forall E; 6$

b)  $\forall x(Px \rightarrow Qx), \forall xPx \vdash \forall xQx$

1. $\forall x(Px \rightarrow Qx)$	(A)
2. $\forall xPx$	(A)
3. $Px \rightarrow Qx$	$\forall B; 1$
4. $Px$	$\forall B; 2$
5. $Qx$	$\rightarrow B; 3, 4$
6. $\forall xQx$	$\forall E; 5$

c)  $\forall x\forall yAxy \vdash \forall y\forall xAxy$

1. $\forall x\forall yAxy$	(A)
2. $\forall yAxy$	$\forall B; 1$
3. $Axy$	$\forall B; 2$
4. $\forall zAxz$	$\forall E; 3$
5. $\forall w\forall zAwz$	$\forall E; 4$
6. $\forall zAwz$	$\forall B; 5$
7. $Awz$	$\forall B; 6$
8. $\forall xAxz$	$\forall E; 7$
9. $\forall y\forall xAxy$	$\forall E; 8$

d)  $\exists x(Ax \wedge Bx) \vdash \exists xAx \wedge \exists xBx$

1. $\exists x(Ax \wedge Bx)$	(A)
2. $Aa \wedge Ba$	(A)
3. $Aa$	$\wedge B1; 2$
4. $Ba$	$\wedge B2; 2$
5. $\exists xAx$	$\exists E; 3$
6. $\exists xBx$	$\exists E; 4$
7. $\exists xAx \wedge \exists xBx$	$\wedge E; 5, 6$
8. $\exists xAx \wedge \exists xBx$	$\exists B; 1, 2, 7$

e)  $\exists xAxx \vdash \exists x\exists yAxy$

1. $\exists xAxx$	(A)
2. $Aaa$	(A)
3. $\exists yAay$	$\exists E; 2$
4. $\exists x\exists yAxy$	$\exists E; 3$
5. $\exists x\exists yAxy$	$\exists B; 1, 2, 4$

f)  $\exists x\exists yAxy \vdash \exists x\exists yAyx$

1. $\exists x\exists yAxy$	(A)
2. $\exists yAay$	(A)
3. $Aab$	(A)
4. $\exists yAyb$	$\exists E; 3$
5. $\exists x\exists yAyx$	$\exists E; 4$
6. $\exists x\exists yAyx$	$\exists B; 2, 3, 5$
7. $\exists x\exists yAyx$	$\exists B; 1, 2, 6$