

By the assertions from the TBox, a list of equivalent predicate logic axioms (AX#1-#8) can be inferred:

1. $\forall x ((\exists y Sxy \rightarrow Ay) \rightarrow Rx)$
2. $\forall x (GRx \leftrightarrow (Gx \wedge Rx))$
3. $\forall x (HRx \rightarrow Px)$
4. $\forall x (HRx \rightarrow Rx)$
5. $\forall x (((\exists y Mxy \rightarrow GRy) \vee (Rx \wedge Px)) \rightarrow HRx)$
6. $\forall x (\exists y Mxy \rightarrow Px)$
7. $\forall x \forall y (Mxy \rightarrow Gy)$
8. $MRx \leftrightarrow POx \wedge Rx$

Further assertions in the ABox (AS#1-#4) state that:

1. $A(\text{teaching})$
2. $S(\text{helpdesk}, \text{teaching})$
3. $M(\text{jim}, \text{helpdesk})$
4. $PO(\text{laptop4})$

From the information above, the questions can be answered as below:

1. Yes. Since helpdesk supports teaching (AS#2) and teaching is an activity (AS#1), by AX#1, there exists a "y" called "teaching" such that Sxy gives Ay . Therefore, helpdesk can be conclude as a resource ($R(\text{helpdesk})$). Moreover, as AS#3 states, jim is member of helpdesk. By AX#7, we can conclude helpdesk is a group ($G(\text{helpdesk})$). By AX#2, helpdesk is thus a group resource ($GR(\text{helpdesk})$). Further referring to AX#5, there exists a "y" called "helpdesk" satisfying jim is member of helpdesk as well as helpdesk is a group resource, therefore jim is a human resource ($HR(\text{jim})$). Finally, by AX#4, jim is a resource ($R(\text{jim})$). QED.
2. $\text{Person} \sqcap \text{Group} \sqsubseteq \perp$. This would be enough to rule out any object that could be both a person and a group.
3. Yes. Although we cannot conclude that jim is a physical object based on the 8 axioms and 4 assertions above, it is an valid assertion which could pass all constraints in an interpretation while jim is a material resource. Since statement about physical object appears in AX#8 only, and jim is a resource by previous proof, jim is hence a physical object ($PO(\text{jim})$). This could not affect the correctness of any other assertion or axiom. QED.
4. Yes. Jim is a person could be inferred by AX#3 with the evidence of jim is a human resource ($HR(\text{jim})$) which has been proven before, or AX#6 given AS#3. In AX#5 which is the only axiom that has Px as one of its premises, the true value of $P(\text{jim})$ does not affect the correctness of the axiom. Therefore in every interpretation, jim is a person. QED.