1. 本题目共有 2 小问：一个是问好的定义（3 分），另一个问 formal semantics 的作用（2 分）。

（1）Definition

参考答案: For Gruber's definition is unsatisfactory for several reasons: what is a "conceptualization" exactly, and what is a "specification"? Using two nebulous terms to describe a third one does not clarify matters. Why and how "shared"? Is it shared enough when, say, you and I agree on the knowledge represented in the ontology, or do we need a third one or a whole group to support it?

（2）formal semantics 的作用？

参考答案: Formal semantics allows humans and computer systems to exchange knowledge without ambiguity as to their intended meaning, and also makes it possible to use logical deduction to infer additional information from the facts stated explicitly in a knowledge base (an important feature that distinguishes logical languages from other modelling languages such as UML).

这道题目答出两点，分别是语义消歧和允许逻辑推理，缺少一点扣 1 分，缺少两点扣 2 分。

2. 共两小问，7 个小问题，每一个小问题 1 分。

（1）University $\sqsubseteq \geqslant 3$ hasMember.Top
（2）$\exists$hasMember$^-$.University $\sqsubseteq$ School $\sqcup$ Department $\sqcup$ Faculty
（3）{NJU} $\sqsubseteq$ University $\sqcap$ $\forall$hasMember.$\neg$Faculty
（4）$\exists$hasMember$^-$.{NJU} $\sqsubseteq$ School $\sqcup$ Department

（2）$\forall x(\exists y(\text{hasMember}(y,x) \wedge \text{University}(y)) \rightarrow (\text{School}(x) \vee \text{Department}(x) \vee \text{Faculty}(x)))$
（3）$\text{University}(\text{NJU}) \wedge \forall y(\text{hasMember}(\text{NJU}, y) \rightarrow \neg\text{Faculty}(y))$
（4）$\forall x(\text{hasMember}(\text{NJU},x) \rightarrow (\text{School}(x) \vee \text{Department}(x)))$

3. 共 7 个小问题，每一个小问题 1 分。

（1）{1,2}
（2）{1,3,4}
（3）{1}
（4）{4}
（5）{1,2}

4.
答案: Considering all those different renderings of the same knowledge, remember that an ontology is an engineering artefact that has to have a machine-processable format that faithfully adheres to the logic. None of these aforementioned representations are easily computer-processable, however. To this end, there are serializations of the ontology into a text file that are easily computer-processable.

本题目需要从 easily machine-processable 的角度回答。

5.

✧ 第一题答案如下：

As C is already in NNF, the tableaux algorithm starts with

$$S_0 = \{x: \neg A \sqcap \exists r.(A \sqcup B) \sqcap \forall r.\neg B\}$$

An application of the AND rule gives:

$$S_1 = S_0 \cup \{x: \neg A, x: (\exists r.(A \sqcup B) \sqcap \forall r.\neg B)\}$$

An application of the AND rule gives:

$$S_2 = S_1 \cup \{ x: \exists r.(A \sqcup B), x: \forall r.\neg B)\}$$

An application of the EXISTS rule gives:

$$S_3 = S_2 \cup \{(x,y): r, y: (A \sqcup B), x: \forall r.\neg B)\}$$

An application of the OR rule gives:

$$S_4 = S_3 \cup \{ y: B, x: \forall r.\neg B)\}$$

An application of the FORALL rule gives:

$$S_5 = S_4 \cup \{y: \neg B)\}$$

Back to S3 and an application of the OR rule gives:

$$S_5 = S_4 \cup \{y: A\}$$

Saturated without clash, therefore C is satisfiable.

✧ 第二题答案如下：

Δ^I={a,b,c,d}
Professor^I={a}
School^I={b}
ResearchGroup^I={c}
ResearchStudent^I={c}
University^I={d}
affliated_with^I={(b,d)}
supervises^I={(a,c)}

The resulting TBox is satisfiable. For example, every I in which Professor^I = emptyset and School^I = emptyset is a model of the extended TBox. Note, however, that Professor is not satisfiable anymore because ResearchGroup and ResearchStudent are disjoint (according to the new inclusion) but every Professor supervises a ResearchGroup and any such research group is, by the value restriction in the third inclusion, a ResearchStudent.

6.

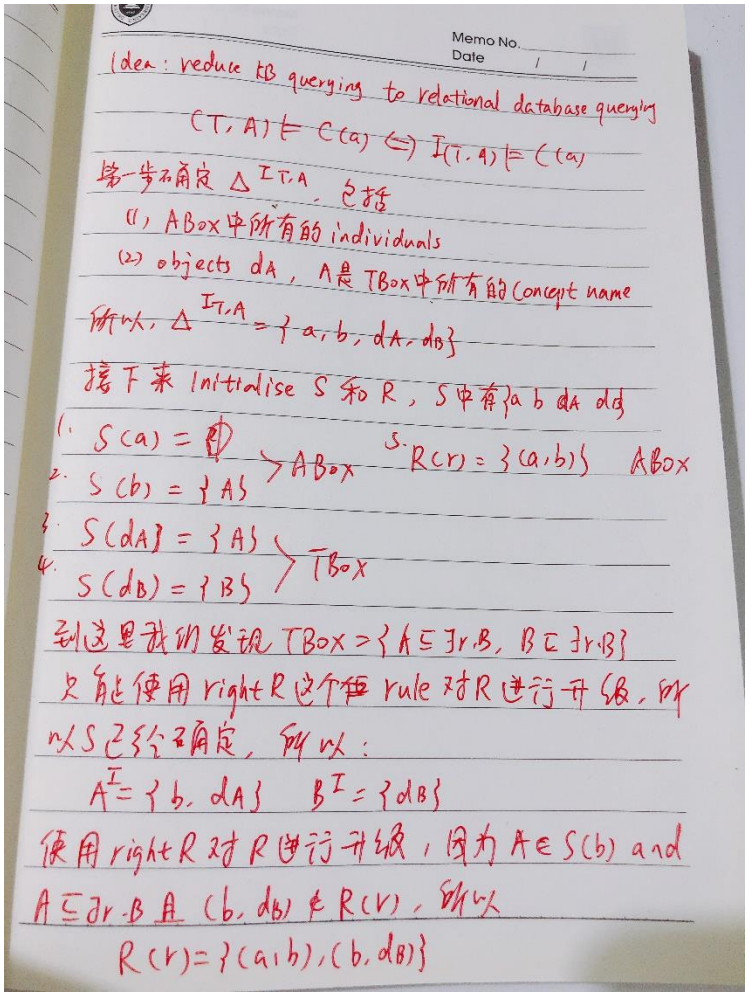
✧ 第一道题答案如下：

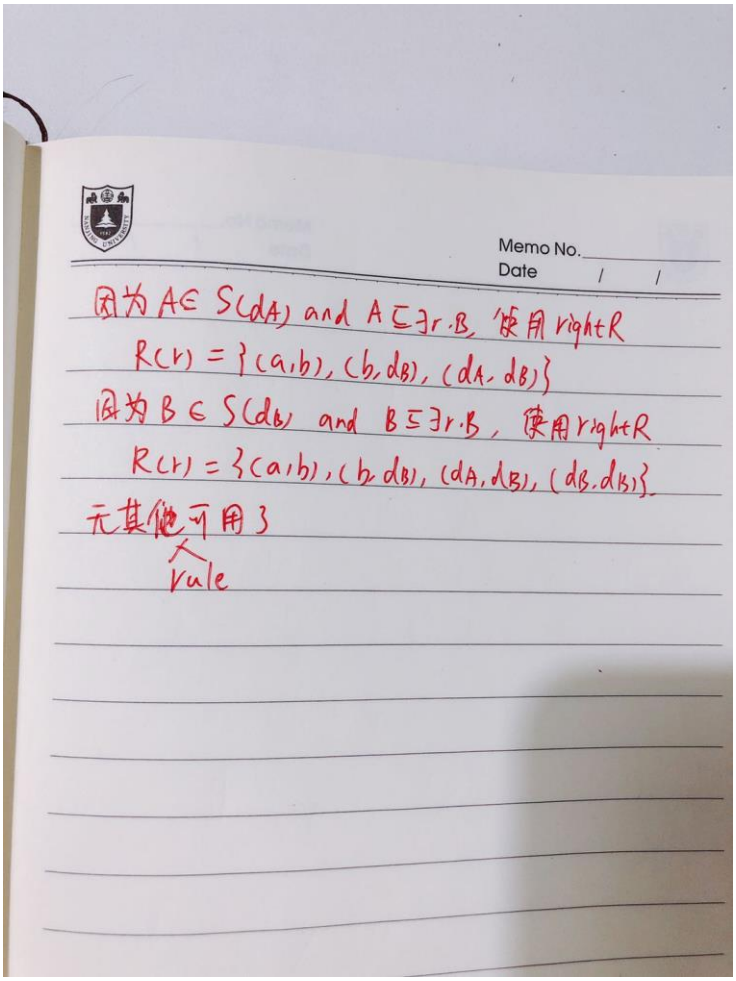
先找 domain，我们从 TBox 的最后一个 inclusion 得知∃breatheWith.Lung 是 domain，并且从第 4 和第 5 个 inclusions 得知 Mammal 和∀breatheWith.Lung 也是 domain。每一小题 1 分。

（1）Cat(gigi) Don’t know
（2）Dog(mimi) Don’t know
（3）Mammal(gigi) Yes
（4）Mammal(dudu) Yes
（5）Lung(krp) Yes
（6）∀breatheWith.Lung(dudu) Yes
（7）∀breatheWith.Lung(lala) Yes
（8）¬Dog(lala) Don’t know

✧ 第二道题目答案：

The interpretation $I = I_{T,A}$ is given by setting:
$\Delta^I=\{a,b,d_A,d_B\}$
$r^I=\{(a,b), (b,d_B), (d_B,d_B), (d_A,d_B)\}$
$A^I=\{b,d_A\}$
$B^I=\{d_B\}$





（可按照上述项目逐个给分）

7. （本题只提供合适的例子即可给满分）

Syntactic Difference（1 分）: works with text files and represents the difference between versions as blocks of text present in one version but not another, ignoring any meta-information about the document.

For example, T={A ⊑ B, E ⊑ F} and T’ ={ E ⊑ F, A ⊑ B}

Structural Difference（2 分）: extends the syntactic diff by taking into account structural meta-information about the distinct versions of files compared.

For example, T={A ⊑ E, A ⊑ F} and T’ ={A ⊑ E ⊓ F}

Semantic Difference（2 分）: axioms entailed by one ontology but not the other