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SER 315

Assignment 4 - Z-Notation

Task 1: Understand Z-Notation (21 points - 3 each)

1. $\forall a : Appointment \bullet \exists t : Tutor \bullet (t,a) \in Oversees$
- *For all appointments there exist a tutor with a link to this appointment.*
- *predicate*
- *true*

2. $\{a : Appointment \mid \exists s : Student \bullet (s, a) \in Books\}$
- A set of appointments which there exist a student with a link to this appointment.
- set
- {Appt-4671, Appt-9810, Appt-8473}

3. $\exists t : Tutor \bullet \{a : Appointment \mid (t,a) \in Oversees\} = 3$
- There exist a tutor with a set of cardinality equal to 3. This set of appointments which is linked to this tutor.
- predicate
- False

4. $\{t : Tutor \mid \forall s : Subject \bullet (t,s) \in Signs\_up\_for\}$
- A set of tutors which for all subjects have a link to this tutor.
- Set
- {}

5. $\exists t : Tutor \bullet \exists s : Subject \bullet s.name = History \land (t,s) \in Signs\_up\_for \land \exists a : Appointment \bullet a.time = 17:30 \land (t, a) \in Oversees$
- *There exist a tutor with a subject with a name equal to History and this tutor has a link to this subject and there exists an appointment with time equal to 17:30 and this appointment is linked to this tutor.*
- *Predicate*
- *true*

6. $\{s : Student \mid \exists a : Appointment \bullet (s,a) \in Books \land \exists t : Tutor \bullet (t,a) \in Oversees \land t.name = Hanna\}$
- A set of students which have an appointment and thee name of the tutor that oversees that appointment is Hanna
- Set
- {Cody, Alan}

7. $\{a : Appointment \mid \exists t : Tutor \bullet (t,a) \in Oversees \land \exists s : Subject \bullet (t,s) \in Signs\_up\_for \land s.name = Algebra\}$
- A set of appointments which there exist a tutor that oversees this appointment and there exist a subject named Algebra that is linked to this tutor.
- Set
- {Appt- 8372, Appt- 1483}

Task 2: Write statements in Z-Notation (30 points - 3 each)

Now you should write statements (as the ones above) in Z-Notation for the following sets or predicates.

Specify a

1. set of all students who have more than 0 credits left. Who would be in this set?
- $\{s : Student \mid s.credit > 0\}$
- {Karl, Cody}

2. predicate evaluating to true if there is a tutor teaching History. Would this evaluate to true or false?
- $\exists t : Tutor \bullet \exists s : Subject \bullet s.name = History \land (t,s) \in Signs\_up\_for$
- *True*

3. **set including appointments booked by Alan. Which appointments are in this set?**
- **{*a* : *Appointment* | ∃ *s* : *Student* • (*s*,*a*) ∈ *Books* ∧ *s.name* = *Alan***
- **{Appt- 9810, Appt- 8473}**

4. **set including all subjects taught by Hanna. Which subjects are in this set?**
- **{*s* : *Subjects* | ∃ *t* : *Tutor* • (*t*,*s*) ∈ *Signs_up_for* ∧ *t.name* = *Hanna*}**
- **{SER}**

5. **predicate evaluating to true if each subject has at least one tutor. Would this evaluate to true or false?**
- **∀ *s* : *Subjects* • ∃ *t : Tutor* • (*t*,*s*) ∈ *Signs_up_for***
- ***true***

6. **predicate that evaluates to true if tutor Hanna has an appointment booked by Cody. Would this evaluate to true or false?**
- **∃ *t* : *Tutor* • ∃ *a* : *Appointment* • ∃ *s* : *Student* • *t.name* = *Hanna* ∧ (*t*,*a*) ∈ *Oversees* ∧ (*s*,*a*) ∈ *Books* ∧ s.name = Cody**
- **true**

7. **predicate that evaluates to true if a student named Cody already has an appointment booked at 17:30. Would this evaluate to true or false?**
- **∃ *s* : *Student* • ∃ *a* : *Appointment* • s.name = Cody ∧ (*s*,*a*) ∈ *Books* ∧ a.time = 17:30**
- **true**

8. **predicate that evaluates to true if students X (use X as name for the student) still has enough credit to book an appointment and does not have an appointment at time Y yet. For which values of X and Y would this evaluate to true?**
- **∃ *s* : *Student* • ∃ *a* : *Appointment* • s.name = X ∧ (*s*,*a*) ∉ *Books* ∧ a.time = Y ∧ s.credit > 0**
- **X = Karl and Y = 14:00 or 17:30**
- **X = Cody and Y = 14:00**

9. **predicate that evaluates to true if all appointments have equal or less than 1 student who booked it.**

- $\forall a : Appointment \bullet \#\{s : Student \mid (s,a) \in Books\} <= 1$

10. **set of all appointments at time Y.**

- $\{a : Appointment \mid a.time = Y\}$