

1. Write corresponding 1st order logic formulas.
Explain the meaning of each symbol (i.e., relation, function, and constants) you use.

1. Bill has at least one sister.
2. Bill has no sister.
3. Bill has at most one sister.
4. Bill has exactly one sister.
5. Bill has at least two sisters.
6. Every student takes at least one course.
7. Only one student failed History.
8. No student failed Chemistry but at least one student failed History.
9. Every student who takes Analysis also takes Geometry.
10. No student can fool all the other students.

2. Write corresponding 1st order logic formula for the following Retail Chain Management SW requirement.

- Explain the meaning of each symbol you use.
- Clearly describe your assumption on the interpretation of ambiguous description
- Note that domain can contain complex data structure such as a tuple/list.

2.1 Write down the Retail Chain Management SW requirement in 1st order logic formula

2.2 Describe one concrete interpretation (i.e. $\mathcal{I} = (\mathcal{D}, \mathcal{R}, \mathcal{F}, \mathcal{C})$) on which your logic formula is true.

2.3 Describe one concrete interpretation (i.e. $\mathcal{I} = (\mathcal{D}, \mathcal{R}, \mathcal{F}, \mathcal{C})$) on which your logic formula is false.

- Requirement on Retail Chain Management SW
 - If the sales for the current month are below the target sales, then a report is to be printed,
 - unless the difference between target sales and actual sales is less than half of the difference between target sales and actual sales in the previous month
 - or if the difference between target sales and actual sales for the current month is under 5 percent.