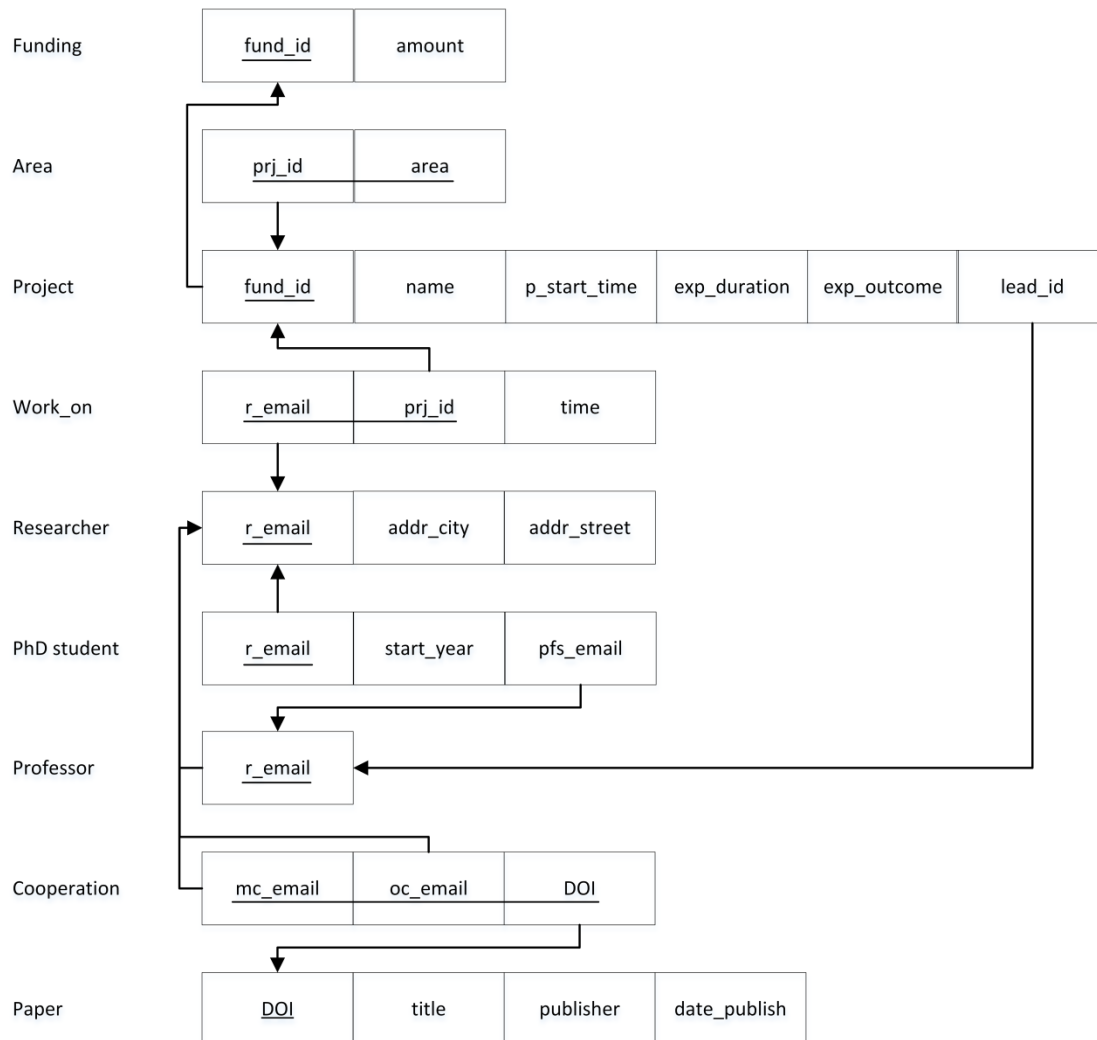


Assignment 1

Question 2 (2 marks)



This relation model is based on ER diagram on page 1 of [Ass1 Q1 solution](#).

Question 3 (4 marks)

1) (1 mark)

$$\pi_{title}(Paper \bowtie_{doi=doi} (\sigma_{name="Jeffrey Ullman"}(Authoring)))$$

2) (1 mark)

$$A \leftarrow \pi_{doi} \left(\left(\sigma_{year=2011}(Paper) \right) \bowtie_{doi=doi} \left(\sigma_{name="Jeffrey Ullman"}(Authoring) \right) \right)$$

$$\pi_{area} \left(Researcher \bowtie_{name=name \text{ and } name \neq "Jeffrey Ullman"} (Authoring \div A) \right)$$

3) (2 marks)

$$A \leftarrow \pi_{doi} \left(\left(\sigma_{year=2011}(Paper) \right) \bowtie_{doi=doi} \left(\sigma_{name="Jeffrey Ullman"}(Authoring) \right) \right)$$

$$B \leftarrow \pi_{name}(Authoring)$$

$$\pi_{area} \left(Researcher \bowtie_{name=name \text{ and } name \neq "Jeffrey Ullman"} \left(B - \pi_{name}((A \times B) - Authoring) \right) \right)$$