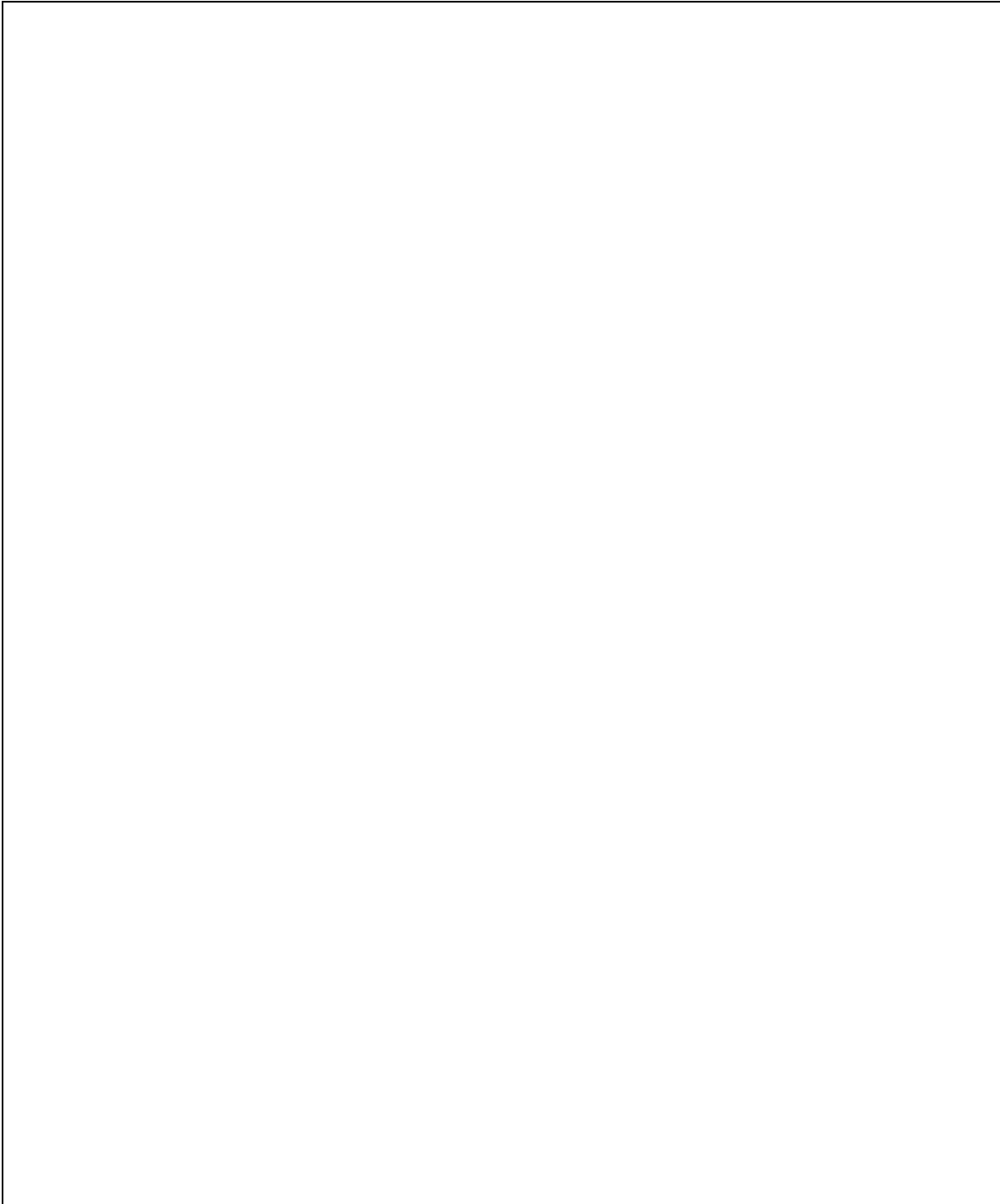


CSIV – Mid-term (Time 60 Minutes, Max marks 20)

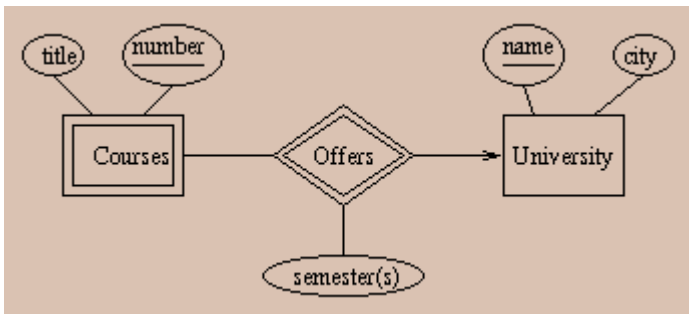
[Note: Use the back of the pages for rough work]

Q1 [5 Marks] Consider the set of functional dependencies (FDs) $\{(a \rightarrow b), (a \rightarrow c), (c \rightarrow b), (a \rightarrow cb)\}$. Clearly, this set is not minimal, because removing the first and the fourth element does not change the overall constraint. This means that they are redundant FDs. Propose a simple algorithm to delete the redundant FDs from a given set.



Q2-a [2 Marks] Does it make sense for an entity in an ER model to ever have a relationship with itself? If so, briefly give an example of such a situation otherwise explain why it doesn't make sense.

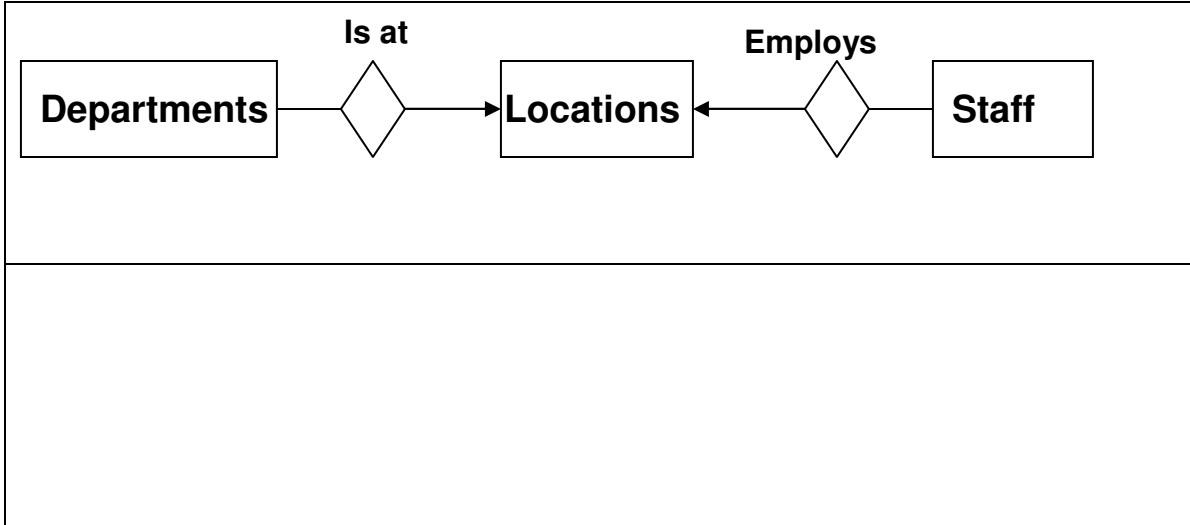
Q2-b [3 Marks] Convert this E/R diagram to relations, eliminating any redundant relations. Show a few meaningful tuples.



Q3 [5 Marks] Show that the following implication holds by using (a) Armstrong's axioms (**2 marks**), and also by (b) attribute closure (**2 marks**). For relation with attributes ABCD (c) find a key (**1 mark**).

$A \rightarrow B$, $BD \rightarrow C$ implies $AD \rightarrow C$

Q4-a [2 Marks] A single university location contains many departments and employs many staff. A possible ER diagram is as follows. If you are interested in identifying which staff work in a particular department then this will not work. Suggest a better scheme.



Q4-b [3 Marks] Consider relation R with attributes ABCD. (a) Is R in BCNF with functional dependencies $AB \rightarrow C$, $AB \rightarrow D$? Why or why not? (b) Is R in BCNF with functional dependencies $A \rightarrow B$, $A \rightarrow C$, $A \rightarrow D$, $D \rightarrow C$? Why, or why not?

Blank area for the answer to Q4-b.