1. Let $R = (A, B, C, D, E)$ be a relation. Let $F = \{AB \rightarrow ABCDE, CD \rightarrow BCDE, C \rightarrow DE\}$ be the set of functional dependencies that hold on $R$.

   (a) Find the canonical cover for $F$. (10)

   (b) Using the algorithm described in class and in the text, create a BCNFLJ decomposition. (10)
2. Create an ER diagram to best represent robots, where robots have multiple functions (such as translation, hacking computers, etc.), a height, a unique designation, a power supply life and a MTTF (mean time to failure) which is calculated as the power supply life divided by the number of functions. A tall robot (> 150 cm) is always paired with a short robot (< 150 cm). Furthermore, tall robots have a number of legs while short robots have a number of wheels.
3. (a) Create a view consisting of a stock id, symbol and closing price for all stocks who were traded on all days that the company with symbol X was traded. (20)
(b) All DBMS’s provide a non-SQL standard clause similar to \textit{LIMIT} \textit{n} which returns only the first \textit{n} rows of the result set. Using this clause and the view created in part (a) of this question, find the k-nearest neighbors to the stock with symbol X (other than company X itself). Use the Euclidean distance of the closing prices as your distance metric.
4. Consider a transaction to be the set of stocks purchased by a single customer. Write an SQL query to find all large two-item sets (with support set to 0.5). Each row in the results should be the two stockids.
5. (a) __________ A schedule is serializable iff (a) the serialization graph is cyclic (b) it is equivalent to a serial schedule (c) it is a serial schedule (d) all of the above (e) none of the above

(b) __________ If a set of attributes functionally determines all of the attributes in the table, that set of attributes is (a) a candidate key (b) a super key (c) a primary key (d) all of the above (e) none of the above

(c) __________ Which of the following is NOT one of Armstrong’s Axioms: (a) reflexivity (b) transitivity (c) augmentation (d) all of the above (e) none of the above

(d) __________ If \( t_i \) reads from \( t_j \) and \( t_i \) commits before \( t_j \) terminates, the resulting schedule is (a) recoverable (b) cascadeless (c) strict (d) all of the above (e) none of the above

(e) __________ According to the rules discussed in class, a schema in 3NF with a simple key has highest normal form (a) 5NF (b) 4NF (c) BCNF (d) 3NF (e) none of the above

(f) __________ The pointers in the leaf node of a unique B+-Tree can point to (a) the physical location of the record containing the value (b) the next leaf node (c) nothing; they are null (d) all of the above (e) none of the above

(g) __________ A transaction is committed when (a) the user enters the commit command (b) automatically when the statement finishes (c) results are returned to the user (d) all of the above (e) none of the above

(h) __________ ORM solves the problem of (a) automatic code generation (b) JDBC bugs (c) impedance mismatch (d) all of the above (e) none of the above

(i) __________ In IR, 100% precision can always be achieved by (a) returning no documents (b) returning all documents (c) returning exactly 1 document (d) achieving 100% recall (e) none of the above

(j) __________ In IR, 100% recall can always be achieved by (a) returning no documents (b) returning all documents (c) returning exactly 1 document (d) achieving 100% precision (e) none of the above