1. One of the challenges for LampQuest is to determine if a hero had slain all of the monsters required for a quest. Note that a quest can require different monsters to be slain, and it can require more than one instance of a monster to be killed. Furthermore, a hero only gets credit for the monsters killed after the quest starts. Write a query to return all of the quest-hero pairs such that the hero has slain all of the monsters required by the quest. You may create views to simplify the query, but they must be defined as part of your answer. Your query and views must be well documented. Use the back of this page if needed.
2. Consider the relation $R = (A, B, C, D, E)$ with FDs $\mathcal{F} = \{AB \rightarrow CD, DE \rightarrow A, E \rightarrow D\}$.

(a) Find the canonical cover for $\mathcal{F}$.  

(b) Using the algorithm from class, find the 3NFLJDP decomposition for $R$ with $\mathcal{F}$.  

(c) Using the algorithm from class, find the BCNFLJ decomposition for $R$ with $\mathcal{F}$.
Multiple Choice

Put the correct letter in the blank.

3. __________ In a $B^+$-tree, the last pointer in non-leaf node points to (a) the next node (b) the subtree with values greater than or equal to the last key value (c) nothing; it is always null (d) the physical location of the row with the last key value (e) none of the above

4. __________ In a $B^+$-tree, when a non-leaf node splits (a) the least value of the greatest half is copied to the parent (b) the value inserted into the database is copied to the parent (c) a new root node is created (d) the height of the tree increases (e) none of the above

5. __________ The relational algebra operator that corresponds to the FROM clause in SQL is (a) $\Pi$ (b) $\sigma$ (c) $\rho$ (d) $\times$ (e) none of the above

6. __________ Which of the following relational algebra expressions are not equivalent to $\sigma_{p_1 \land p_2}(R)$ (a) $\sigma_{p_1}(R) \land \sigma_{p_2}(R)$ (b) $\sigma_{p_1}(R) \lor \sigma_{p_2}(R)$ (c) $\sigma_{p_1}(\sigma_{p_2}(R))$ (d) $\sigma_{p_2}(\sigma_{p_1}(R))$ (e) all of the above are equivalent

7. __________ The SQL isolation level Read Committed (a) allows dirty writes (b) allows unrecoverable schedules (c) allows dirty reads (d) all of the above (e) none of the above

8. __________ If the 3-nn of user $u$ rated item $i$ as 1,1,4 (on a 1-5 scale), the prediction for user $u$ on item $i$ is (a) 1 (b) 2 (c) 4 (d) 6 (e) none of the above

9. __________ In information retrieval, the expression TF is (a) the number of times a word appears in a document (b) the number of words in a document (c) the number of different words that appear in a document (d) the number of documents with the word (e) none of the above

10. __________ Which of the following is NOT a property of the data structure used by Big Table (a) atomic (b) multi-dimensional (c) persistent (d) map (e) all of them are

11. __________ If the three nearest neighbors had values 1,1,4, under classification, the prediction would be (a) 1 (b) 2 (c) 4 (d) 6 (e) none of the above

12. __________ If there exists exactly one large 4-item set, there must exist (a) at least 4 large 3-items sets (b) 4 items with sufficient confidence for a rule (c) at most 4 possible rules over 4 items (d) more 5-item sets (e) none of the above
13. For relation $R = (A, B, C, D, E)$ is the relation and FDs $\{A \rightarrow BCDE, BC \rightarrow A\}$, the highest normal form is (a) 5NF (b) 4NF (c) BCNF (d) 3NF (e) none of the above

14. Which of the following is not part of a three-tier web/database app (a) web server (b) database (c) application server (d) business logic (e) all of the above are part of a three-tier web/database app

15. If $A \rightarrow B$ and $B \rightarrow C$ both hold, then by augmentation we know (a) $B \subseteq A$ (b) $AB \rightarrow AC$ (c) $A \rightarrow C$ (d) $AB \rightarrow BC$ (e) none of the above

16. Given an ER diagram with a many-to-many relationship $R$ between entities $E_1$ and $E_2$ such that $R$ has no attributes (a) we should create a table for the relationship (b) we should add foreign keys to the tables for $E_1$ and $E_2$ but not create a table for $R$ (c) we should ignore $R$ completely (d) we should create one table with $E_1$ and $E_2$ combined (e) none of the above

17. Within the LampQuest game, an example of a derived attribute would be (a) the level of a quest (b) the level of the men at arms (c) the level required to use an item (d) the level of the hero (e) none of the above

18. When inserting into a table (a) you must give every attribute a value (b) you must start a transaction if using a query to insert multiple rows (c) you must not violate a consistency constraint (d) all of the above (e) none of the above

19. Within JDBC, the ResultSet method next() (a) returns the number of rows returned by the query (b) must be called before the first row can be accessed (c) always returns true the first time it is called (d) when called multiple times, returns the same value if no data is retrieved from the query (e) none of the above

20. Which of the following is NOT true for the SQL operator EXCEPT (a) is not supported by MySQL (b) requires union compatible attributes (c) is similar to the set difference operator (d) is used in subset queries (e) all of the above are true

21. Which of the following is not an SQL aggregate operator (a) COUNT (b) AVG (c) MAX (d) SUM (e) all of them are

22. If LampQuest allowed users to upload pictures of their heroes, the best data type to store the pictures would be (a) varchar (b) bit string (c) blob (d) clob (e) none of the above