

# DOMANDE E RISPOSTE MACHINE LEARNING

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Nella **parte 1** si trovano le domande senza highlighting delle risposte corrette, mentre nella **parte 2** si trovano le domande comprendenti delle risposte corrette in **grassetto**.

## PARTE 1: Domande senza risposte corrette

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### 1) Which is different from the others:

- Expectation Maximisation
- Apriori
- K-means
- Decision Tree

### 2) What is the cross validation:

- A technique to obtain a good estimation of the performance of a classifier when it will be used with data different from the training set
- A technique to obtain a good estimation of the performance of a classifier with the training set
- A technique to improve the quality of a classifier
- A technique to improve the speed of a classifier

### 3) What is the single linkage?

- A method to compute the distance between two objects, it can be used in hierarchical clustering
- A method to compute the distance between two sets of items, it can be used in hierarchical clustering
- A method to compute the distance between two classes, it can be used in decision trees
- A method to compute the separation of the objects inside a cluster

### 4) Which of the following characteristic of data can reduce the effectiveness of DBSCAN?

- Clusters have concavities
- All the variables are the same range of values
- Presence of outliers
- Presence of clusters with different densities

**5) Which of the following types of data allows the use of the euclidean distance?**

- Points in a vector space
- Ordered data
- Transactional data
- Document representations

**6) How does pruning work when generating frequent itemsets?**

- If an itemset is not frequent, then none of its supersets can be frequent, therefore the frequencies of the supersets are not evaluated
- If an itemset is frequent, then none of its supersets can be frequent, therefore the frequencies of the supersets are not evaluated
- If an itemset is not frequent, then none of its subsets can be frequent, therefore the frequencies of the subsets are not evaluated
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**7) In a decision tree, the number of objects in a node...**

- ... is smaller than the number of objects in its ancestor
- ... is not related to the number of objects in its ancestor
- ... is smaller than or equal to the number of objects in its ancestor
- ... is bigger than the number of objects in its ancestor

**8) What does K-means try to minimise?**

- The distortion, that is the sum of the squared distances of each point with respect to the points of the other clusters
- The distortion, that is the sum of the squared distances of each point with respect to its centroid
- The separation, that is the sum of the squared distances of each point with respect to its centroid
- The separation, that is the sum of the squared distances of each cluster centroid with respect to the global centroid of the dataset

**9) Given the following definitions: TP = True Positives; TN = True Negatives; FP = False Positives; FN = False Negatives. Which of the formulas below computes the precision of a binary classifier?**

- $TP / (TP + FP)$
- $(TP + TN) / (TP + FP + TN + FN)$
- $TN / (TN + FP)$
- $TP / (TP + FN)$

**10) Given the two binary vectors below, which is their similarity according to the Jaccard Coefficient?**

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- 0.1
- 0.2
- 0.5
- 0.375

**11) Consider the transactional dataset below:**

ID Items

1 A,B,C

2 A,B,D

3 B,D,E

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5 A,C,D,E

**Which is the support of the rule  $A,C \rightarrow B$** 

- 100%
- 20%
- 40%
- 50%

**12) Which of the following statements is true?**

- The noise can generate outliers
- The noise always generate outliers
- The data which are similar to the majority are never noise
- Outliers can be due to noise

**13) Which of the following clustering methods is not based on distances between objects?**

- Hierarchical Agglomerative
- DBSCAN
- K-Means
- Expectation Maximization

**14) In a decision tree, an attribute which is used only in nodes near the leaves...**

- ... is irrelevant with respect to the target
- ... guarantees high increment of purity
- ... gives little insight with respect to the target
- ... has a high correlation with respect to the target

**15) Which of the statements below is true? (Only one)**

- Sometimes k-means stops to a configuration which does not give the minimum distortion for the chosen value of the number of clusters
- K-means always stop to a configuration which gives the minimum distortion for the chosen value of the number of clusters
- K-means works well also with datasets having a very large number of attributes
- K-means finds the number of clusters which give the minimum distortion

**16) Which of the statements below is true? (One or more)**

- Increasing the radius of the neighbourhood can decrease the number of noise points
- DBSCAN always stops to a configuration which gives the optimal number of clusters
- Sometimes DBSCAN stops to a configuration which does not include any cluster
- DBScan can give good performance when clusters have concavities

**17) In data preparation which is the effect of normalisation?**

- Map all the numeric attributes to the same range, without altering the distribution, in order to avoid that attributes with large ranges have more influence
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- Requires the definition of distance between sets of objects
- Is very efficient also with large datasets
- Is based on a well founded statistical model

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- The slope of the activation function in a specific node
- A multiplying factor of the correction to be applied to the connection weights

**21) What are the hyperparameters of a Neural Network? (Possibly non exhaustive)**

- Hidden layers structure, Output layer structure, Activation function, Number of epochs
- Network structure, Learning rate, Backpropagation algorithm, Number of epochs
- Input layers structure, Learning rate, Activation function, Number of epochs
- Hidden layers structure, Learning rate, Activation function, Number of epochs

**22) Which of the following preprocessing activities is useful to build a Naive Bayes classifier if the independence hypothesis is violated:**

- Discretisation
- Normalisation
- Standardisation
- Feature selection

**23) Which is different from the others?**

- Silhouette Index
- Misclassification Error
- Entropy
- Gini Index

**24) Why do we prune a decision tree?**

- To eliminate parts of the tree where the decisions could be influenced by random effects
- To eliminate rows of the dataset which could be influenced by random effects
- To eliminate parts of the tree where the decision could generate underfitting
- To eliminate attributes which could be influenced by random effects

**25) In a dataset with  $D$  attributes, how many subsets of attributes should be considered for feature selection according to an exhaustive search?**

- $O(2^D)$
- $O(D!)$
- $O(D)$
- $O(D^2)$

**26) In which mining activity the Information Gain can be useful?**

- Discovery of association rules
- Classification
- Clustering
- Discretization

**27) Given the two binary vectors below, which is their similarity according to the Simple Matching Coefficient?**

1 0 0 0 1 0 1 1 0 1  
1 0 1 1 1 0 1 0 1 0

- 0.1
- 0.3
- 0.5
- 0.2

**28) Which is the main reason for the standardization of numeric attributes?**

- Change the distribution of the numeric attributes, in order to obtain gaussian distributions
- Map all the numeric attributes to a new range such that the mean is zero and the variance is one
- Map all the nominal attributes to the same range, in order to prevent the values with higher frequency from having prevailing influence
- Remove non-standard values

**29) Which of the following measure can be used as an alternative to the Information Gain?**

- Silhouette Index
- Gini Index
- Rand Index
- Jaccard Index

**30) Which of the following is not an objective of feature selection**

- Select the features with higher range, which have more influence on the computation
- Reduce time and memory complexity of the mining algorithms
- Reduce the effect of noise
- Avoid the curse of dimensionality

**31) After fitting DBSCAN with the default parameter values the results are: 0 clusters, 100% of noise points. Which will be your next trial?**

- Reduce the minimum number of objects in the neighborhood
- Reduce the minimum number of objects in the neighborhood and the radius of the neighborhood
- Increase the radius of the neighborhood
- Decrease the radius of the neighborhood

**32) What is the meaning of the statement "*the support is anti-monotone*"?**

- The support of an itemset never exceeds the support of its subsets
- The support of an itemset is always smaller than the support of its supersets
- The support of an itemsets never exceeds the support of its supersets
- The support of an itemset is always smaller than the support of its subsets

**33) In feature selection, what is the Principal Component Analysis?**

- A mathematical technique used to transform non numeric attributes into numeric attributes
- A mathematical technique used to transform a set of numeric attributes into a smaller set of numeric attributes which capture most of the variability in data
- A heuristic technique used to find a subset of the attributes which produces the same classifier
- A mathematical technique used to find the principal attributes which determine the classification process

**34) A Decision Tree is...**

- A tree-structured plan of tests on single attributes to forecast the cluster
- A tree-structured plan of tests on single attributes to forecast the target
- A tree-structured plan of tests on single attributes to obtain the maximum purity of a node
- A tree-structured plan of tests on multiple attributes to forecast the target

**35) In data preprocessing, which of the following are the objectives of the aggregation of attributes?**

- Obtain a more detailed description of data
- Obtain a less detailed scale
- Reduce the variability of data
- Reduce the number of attributes or distinct values

**36) In order to reduce the dimensionality of a dataset, which is the advantage of Multi Dimensional Scaling (MDS), with respect to Principal Component Analysis (PCA)**

- MDS requires less computational power
- MDS can be used also with categorical data, provided that the matrix of the distance is available, while PCA is limited to vector spaces
- MDS can be used with categorical data after a transformation in a vector space
- MDS can work on any kind of data, while PCA is limited to categorical data

**37) What is the main purpose of smoothing in Bayesian classification?**

- Classifying an object containing attribute values which are missing from some classes in the training set
- Dealing with missing values
- Reduce the variability of the data
- Classifying an object containing attribute values which are missing from some classes in the test set

**38) Consider the transactional dataset below:**

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2 A,B,D

3 B,D,E

4 C,D

5 A,C,D,E

**Which is the confidence of the rule B -> E ?**

- 100%
- 50%
- 33%
- 20%



**39) In a Decision Tree for classification, what is a leaf node?**

- A node which assigns a class value to the objects passing the tests on the path from the root to the node itself
- A node where all the objects belong to the same class
- A node which allows classification without errors
- A node which assigns a class value only by majority of examples

**40) Match the rule evaluation formulas with their names:**

1.  $\text{sup}(A \cup C) - \text{sup}(A)\text{sup}(C)$

2.  $\frac{\text{conf}(A \Rightarrow C)}{\text{sup}(C)}$

3.  $\frac{\text{sup}(A \Rightarrow C)}{\text{sup}(A)}$

4.  $\frac{1 - \text{sup}(C)}{1 - \text{conf}(A \Rightarrow C)}$

Options:

- Confidence  $\rightarrow$  \_\_\_
- Lift  $\rightarrow$  \_\_\_
- Leverage  $\rightarrow$  \_\_\_
- Conviction  $\rightarrow$  \_\_\_

**41) Which of the statements below best describes the strategy of Apriori in finding the frequent itemsets?**

- Evaluation of the support of the itemsets in an order such that uninteresting parts of the search space are considered only at the end of the execution
- Evaluation of the confidence of the itemsets in an order such that uninteresting parts of the search space are pruned as soon as possible
- Evaluation of the support of the itemsets in an order such that uninteresting parts of the search space are pruned as soon as possible
- Evaluation of the support of the itemsets in an order such that the interesting parts of the search space are pruned as soon as possible

**42) What is the Gini index?**

- A measure of the entropy of a dataset
- An accuracy measure of a dataset alternative to the Information Gain and to the Misclassification Index
- An impurity measure of a dataset alternative to the Information Gain and to the Misclassification Index
- An impurity measure of a dataset alternative to overfitting and underfitting

**43) What measure is maximised by the Expectation Maximisation algorithm for clustering?**

- The likelihood of a class label, given the attributes of the example
- The likelihood of an attribute, given the class label
- The likelihood of an example
- The support of a class

**44) Given the following definitions: TP = True Positives; TN = True Negatives; FP = False Positives; FN = False Negatives. Which of the formulas below computes the accuracy of a binary classifier?**

- $TN / (TN + FP)$
- $(TP + TN) / (TP + FP + TN + FN)$
- $TP / (TP + FN)$
- $TP / (TP + FP)$

**45) In data preprocessing, which of the following is not an objective of the aggregation of attributes**

- Reduce the variability of data
- Obtain a less detailed scale
- Reduce the number of attributes or objects
- Obtain a more detailed description of data

**46) Which of the following is a strength of the clustering algorithm DBSCAN?**

- Requires to set the number of clusters as a parameter
- Ability to find cluster with concavities
- Ability to separate outliers from regular data
- Very fast by computation

**47) Which of the following statements regarding the discovery of association rules is true? (One or more)**

- The confidence of a rule can be computed starting from the supports of the itemsets
- The support of an itemset is anti-monotonic with respect to the composition of the itemset
- The support of a rule can be computed given the confidence of the rule
- The confidence of an itemset is anti-monotonic with respect to the composition of the itemset

**48) For each type of data choose the best suited distance function**

- Vector space with real values -> \_\_\_\_
- Vectors of terms representing documents -> \_\_\_\_
- High dimensional spaces -> \_\_\_\_
- Boolean data -> \_\_\_\_

**49) Which of the following is not a strength point of Dbscan with respect to K-means**

- The robustness with respect to outliers
- The effectiveness, even in presence of noise
- The effectiveness even if there are clusters with non-convex shape
- The efficiency even in large datasets

**50) Which is the effect of the curse of dimensionality**

- When the number of dimensions increases the results tend to be prone to overfitting
- When the number of dimensions increases the euclidean distance becomes less effective to discriminate between points in the space
- When the number of dimensions increases the computing power necessary to compute the distances becomes too high
- When the number of dimensions increases the classifiers cannot be correctly tuned

**51) Which is different from the others?**

- Expectation Maximisation
- Decision Tree
- K-means
- Dbscan

**52) In a Neural Network, what is the backpropagation?**

- The technique used to adjust the node weights according to the difference between the desired output and the output generated by the network
- The technique used to adjust the weights limiting the probability of overfitting
- The technique used to adjust the output according to the difference between the desired weights and the actual weights
- The technique used to adjust the connection weights according to the difference between the desired output and the output generated by the network

**53) Which is different from the others?**

- Dbscan
- SVM
- Neural Network
- Decision Tree

**54) Which of the following is not a property of a metric distance function**

- Symmetry
- Positive definiteness
- Triangle inequality
- Boundedness

**55) Which of the statements below is true? (One or more)**

- K-mean always stops to a configuration which gives the minimum distortion for the chosen value of the number of clusters
- K-means is very sensitive to the initial assignment of the centers
- K-means is quite efficient even for large datasets
- Sometimes k-means stops to a configuration which does not give the minimum distortion for the chosen value of the number of clusters

**56) Which of the following characteristic of data can reduce the effectiveness of K-Means?**

- Presence of values with high frequency
- Presence of outliers
- All the variables have the same distribution of values
- All the variables have the same range of values

**57) Which is the purpose of discretisation?**

- Increase the number of distinct values in an attribute, in order to put in evidence possible patterns and regularities
- Reduce the number of distinct values in an attribute, in order to increase the efficiency of the computations
- Reduce the number of distinct values in an attribute, in order to put in evidence possible patterns and regularities
- Reduce the range of values of a numeric attribute, to make all the attributes more comparable

**58) Given the following definitions: TP = True Positives; TN = True Negatives; FP = False Positives; FN = False Negatives. Which of the formulas below computes the recall of a binary classifier?**

- $TP / (TP + FN)$
- $TN / (TN + FP)$
- $TP / (TP + FP)$
- $(TP + TN) / (TP + FP + TN + FN)$

**59) The Information Gain is used to**

- select the attribute which maximises, for a given training set, the ability to predict the class value
- select the attribute which maximises, for a given test set, the ability to predict the class value
- select the attribute which maximises, for a given training set, the ability to predict all the other attribute values
- select the class with maximum probability

**60) Which is the main reason for the MinMax scaling (also known as "rescaling") of attributes?**

- Change the distribution of the numeric attributes, in order to obtain gaussian distributions
- Map all the nominal attributes to the same range in order to prevent the values with higher frequency from having prevailing influence
- Remove abnormal values
- Map all the numeric attributes to the same range, in order to prevent attributes with higher range from having prevalent influence

**61) Which of the following is a base hypothesis for a bayesian classifier?**

- The attributes must be statistically independent inside each class
- The attributes must have negative correlation
- The attributes must be statistically independent
- The attributes must have zero correlation

**62) When developing a classifier, which of the following is a symptom of overfitting?**

- The error rate in the test set is much smaller than the error rate in the training set
- The precision is much greater than the recall
- The error rate in the test set is more than 30%
- The error rate in the test set is much greater than the error rate in the training set

**63) With reference to the total sum of squared errors and separation of a clustering scheme, which of the statements below is true?**

- They are two ways to measure the same thing
- They are strictly correlated, if, changing the clustering scheme, one increases, then the other does the same
- It is possible to optimise them (i.e. minimise SSE and maximise SSB) separately
- They are strictly correlated, if, changing the clustering scheme, one increases, then the other decreases

**64) How can we measure the quality of a trained regression model?**

- With a formula elaborating the difference between the forecast values and the true ones
- With a confusion matrix
- Counting the number of values correctly forecast
- With precision, recall and accuracy

**65) What is the coefficient of determination  $R^2$ ?**

- Provide an index of goodness for a linear regression model
- Measure the amount of error in a linear regression model
- Measure the amount of error in a regression model
- An index of goodness for a classification model

**66) What measure is maximised by the Expectation Maximisation algorithm for clustering?**

Scegli un'alternativa:

- The likelihood the distributions, defined by the parameters found, given the data available
- The likelihood of an example
- The support of a class
- The likelihood of an attribute, given the class label

**67) What is the difference between classification and regression?**

- Classification has a categorical target, while regression has a numeric target
- Classification is a supervised activity. while regression is unsupervised
- Classification can make errors, while regression is always exact
- Classification can have a numeric or categorical target, while regression has always a categorical target

**68) When is polynomial regression appropriate?**

- When the relationship between the predicting variable and the target cannot be approximated as linear
- When the target values are not linearly separable
- When there is more than one predicting attribute
- When it is necessary to project the data into a dimensional space

**69) How is the number of clusters determined in agglomerative clustering?**

- By assigning each data point to a cluster based on the final structure obtained from the dendrogram.
- By cutting the dendrogram at a certain height.
- By merging the closest clusters according to the defined distance metric.
- By computing the pairwise similarity or distance between all clusters.

**70) In data preprocessing, which of the operations below performs aggregation?**

- Combination of two attributes in order to obtain a more general attribute with smaller variability
- Reduction of the number of distinct values of an attribute. in order to reduce its variability
- Reduction of the number of rows of the dataset by applying a grouping on one or more attributes and computing the measures as the results of aggregation functions
- Combination of two or more datasets in order to obtain more information

**71) Match specific situations of data to the most appropriate pre-processing activity**

- The numeric attributes have very diverse ranges of values : \_\_\_\_
- An attribute has a very skewed distribution (e.g. most of the values concentrated in a small range, and a very long tail of outliers: \_\_\_\_
- A categorical attribute has a too large number of distinct values: \_\_\_\_
- A nominal attribute needs to be used as predicting when using the sklearn library: \_\_\_\_

Alternatives:

- Aggregation
- Ordinal Encoding
- Rescaling
- Non linear transformations
- OneHot Encoding

**72) What is the first step in agglomerative clustering?**

Scegli un'alternativa:

- Cutting the Dendrogram: Decide on the number of clusters by cutting the dendrogram at a certain height
- Pairwise Cluster Similarity Calculation: Compute the pairwise similarity or distance between all clusters
- Initialization: Start with each data point as a singleton cluster
- Cluster Assignment: Assign each data point to a cluster based on the final structure obtained from the dendrogram

**73) Which of the following situations could suggest the use of MinMax scaling? (also known as "rescaling")**

- There are numeric attributes with very diverse value ranges
- There are attributes with very skewed data distributions
- There are attributes with a very large number of missing values
- There is a numeric attribute with values spread in a very large range

## PARTE 2: Domande con risposte corrette (in grassetto)

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### 1) Which is different from the others:

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- K-means
- **Decision Tree**

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- Network structure, Learning rate, Backpropagation algorithm, Number of epochs
- Input layers structure, Learning rate, Activation function, Number of epochs
- **Hidden layers structure, Learning rate, Activation function, Number of epochs**

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- Clustering
- Discretization

**27) Given the two binary vectors below, which is their similarity according to the Simple Matching Coefficient?**

1 0 0 0 1 0 1 1 0 1  
1 0 1 1 1 0 1 0 1 0

- 0.1
- 0.3
- **0.5**
- 0.2

**28) Which is the main reason for the standardization of numeric attributes?**

- Change the distribution of the numeric attributes, in order to obtain gaussian distributions
- **Map all the numeric attributes to a new range such that the mean is zero and the variance is one**
- Map all the nominal attributes to the same range, in order to prevent the values with higher frequency from having prevailing influence
- Remove non-standard values

**29) Which of the following measure can be used as an alternative to the Information Gain?**

- Silhouette Index
- **Gini Index**
- Rand Index
- Jaccard Index

**30) Which of the following is not an objective of feature selection**

- **Select the features with higher range, which have more influence on the computation**
- Reduce time and memory complexity of the mining algorithms
- Reduce the effect of noise
- Avoid the curse of dimensionality

**31) After fitting DBSCAN with the default parameter values the results are: 0 clusters, 100% of noise points. Which will be your next trial?**

- **Reduce the minimum number of objects in the neighborhood**
- Reduce the minimum number of objects in the neighborhood and the radius of the neighborhood
- **Increase the radius of the neighborhood**
- Decrease the radius of the neighborhood

**32) What is the meaning of the statement "*the support is anti-monotone*"?**

- **The support of an itemset never exceeds the support of its subsets**
- The support of an itemset is always smaller than the support of its supersets
- The support of an itemsets never exceeds the support of its supersets
- The support of an itemset is always smaller than the support of its subsets

**33) In feature selection, what is the Principal Component Analysis?**

- A mathematical technique used to transform non numeric attributes into numeric attributes
- **A mathematical technique used to transform a set of numeric attributes into a smaller set of numeric attributes which capture most of the variability in data**
- A heuristic technique used to find a subset of the attributes which produces the same classifier
- A mathematical technique used to find the principal attributes which determine the classification process

**34) A Decision Tree is...**

- A tree-structured plan of tests on single attributes to forecast the cluster
- **A tree-structured plan of tests on single attributes to forecast the target**
- A tree-structured plan of tests on single attributes to obtain the maximum purity of a node
- A tree-structured plan of tests on multiple attributes to forecast the target

**35) In data preprocessing, which of the following are the objectives of the aggregation of attributes?**

- Obtain a more detailed description of data
- **Obtain a less detailed scale**
- **Reduce the variability of data**
- **Reduce the number of attributes or distinct values**

**36) In order to reduce the dimensionality of a dataset, which is the advantage of Multi Dimensional Scaling (MDS), with respect to Principal Component Analysis (PCA)**

- MDS requires less computational power
- **MDS can be used also with categorical data, provided that the matrix of the distance is available, while PCA is limited to vector spaces**
- MDS can be used with categorical data after a transformation in a vector space
- MDS can work on any kind of data, while PCA is limited to categorical data

**37) What is the main purpose of smoothing in Bayesian classification?**

- **Classifying an object containing attribute values which are missing from some classes in the training set**
- Dealing with missing values
- Reduce the variability of the data
- Classifying an object containing attribute values which are missing from some classes in the test set

**38) Consider the transactional dataset below:**

ID Items

1 A,B,C

2 A,B,D

3 B,D,E

4 C,D

5 A,C,D,E

**Which is the confidence of the rule B -> E ?**

- 100%
- 50%
- **33%**
- 20%

**39) In a Decision Tree for classification, what is a leaf node?**

- **A node which assigns a class value to the objects passing the tests on the path from the root to the node itself**
- A node where all the objects belong to the same class
- A node which allows classification without errors
- A node which assigns a class value only by majority of examples

**40) Match the rule evaluation formulas with their names:**

1.  $\text{sup}(A \cup C) - \text{sup}(A)\text{sup}(C)$

2.  $\frac{\text{conf}(A \Rightarrow C)}{\text{sup}(C)}$

3.  $\frac{\text{sup}(A \Rightarrow C)}{\text{sup}(A)}$

4.  $\frac{1 - \text{sup}(C)}{1 - \text{conf}(A \Rightarrow C)}$

Options:

- Confidence → 3
- Lift → 2
- Leverage → 1
- Conviction → 4



**41) Which of the statements below best describes the strategy of Apriori in finding the frequent itemsets?**

- Evaluation of the support of the itemsets in an order such that uninteresting parts of the search space are considered only at the end of the execution
- Evaluation of the confidence of the itemsets in an order such that uninteresting parts of the search space are pruned as soon as possible
- **Evaluation of the support of the itemsets in an order such that uninteresting parts of the search space are pruned as soon as possible**
- Evaluation of the support of the itemsets in an order such that the interesting parts of the search space are pruned as soon as possible

**42) What is the Gini index?**

- A measure of the entropy of a dataset
- An accuracy measure of a dataset alternative to the Information Gain and to the Misclassification Index
- **An impurity measure of a dataset alternative to the Information Gain and to the Misclassification Index**
- An impurity measure of a dataset alternative to overfitting and underfitting

**43) What measure is maximised by the Expectation Maximisation algorithm for clustering?**

- **The likelihood of a class label, given the attributes of the example**
- The likelihood of an attribute, given the class label
- The likelihood of an example
- The support of a class

**44) Given the following definitions: TP = True Positives; TN = True Negatives; FP = False Positives; FN = False Negatives. Which of the formulas below computes the accuracy of a binary classifier?**

- $TN / (TN + FP)$
- **$(TP + TN) / (TP + FP + TN + FN)$**
- $TP / (TP + FN)$
- $TP / (TP + FP)$

**45) In data preprocessing, which of the following is not an objective of the aggregation of attributes**

- Reduce the variability of data
- Obtain a less detailed scale
- Reduce the number of attributes or objects
- **Obtain a more detailed description of data**

**46) Which of the following is a strength of the clustering algorithm DBSCAN?**

- Requires to set the number of clusters as a parameter
- **Ability to find cluster with concavities**
- **Ability to separate outliers from regular data**
- Very fast by computation

**47) Which of the following statements regarding the discovery of association rules is true? (One or more)**

- **The confidence of a rule can be computed starting from the supports of the itemsets**
- **The support of an itemset is anti-monotonic with respect to the composition of the itemset**
- The support of a rule can be computed given the confidence of the rule
- The confidence of an itemset is anti-monotonic with respect to the composition of the itemset

**48) For each type of data choose the best suited distance function**

- Vector space with real values -> **euclidean distance**
- Vectors of terms representing documents -> **cosine distance**
- High dimensional spaces -> **manhattan distance**
- Boolean data -> **jaccard coefficient**

**49) Which of the following is not a strength point of Dbscan with respect to K-means**

- The robustness with respect to outliers
- The effectiveness, even in presence of noise
- The effectiveness even if there are clusters with non-convex shape
- **The efficiency even in large datasets**

**50) Which is the effect of the curse of dimensionality**

- When the number of dimensions increases the results tend to be prone to overfitting
- **When the number of dimensions increases the euclidean distance becomes less effective to discriminate between points in the space**
- When the number of dimensions increases the computing power necessary to compute the distances becomes too high
- When the number of dimensions increases the classifiers cannot be correctly tuned

**51) Which is different from the others?**

- Expectation Maximisation
- **Decision Tree**
- K-means
- Dbscan

**52) In a Neural Network, what is the backpropagation?**

- The technique used to adjust the node weights according to the difference between the desired output and the output generated by the network
- The technique used to adjust the weights limiting the probability of overfitting
- The technique used to adjust the output according to the difference between the desired weights and the actual weights
- **The technique used to adjust the connection weights according to the difference between the desired output and the output generated by the network**

**53) Which is different from the others?**

- **Dbscan**
- SVM
- Neural Network
- Decision Tree

**54) Which of the following is not a property of a metric distance function**

- Symmetry
- Positive definiteness
- Triangle inequality
- **Boundedness**

**55) Which of the statements below is true? (One or more)**

- K-mean always stops to a configuration which gives the minimum distortion for the chosen value of the number of clusters
- **K-means is very sensitive to the initial assignment of the centers**
- **K-means is quite efficient even for large datasets**
- **Sometimes k-means stops to a configuration which does not give the minimum distortion for the chosen value of the number of clusters**

**56) Which of the following characteristic of data can reduce the effectiveness of K-Means?**

- Presence of values with high frequency
- **Presence of outliers**
- All the variables have the same distribution of values
- All the variables have the same range of values

**57) Which is the purpose of discretisation?**

- Increase the number of distinct values in an attribute, in order to put in evidence possible patterns and regularities
- Reduce the number of distinct values in an attribute, in order to increase the efficiency of the computations
- **Reduce the number of distinct values in an attribute, in order to put in evidence possible patterns and regularities**
- Reduce the range of values of a numeric attribute, to make all the attributes more comparable

**58) Given the following definitions: TP = True Positives; TN = True Negatives; FP = False Positives; FN = False Negatives. Which of the formulas below computes the recall of a binary classifier?**

- **$TP / (TP + FN)$**
- $TN / (TN + FP)$
- $TP / (TP + FP)$
- $(TP + TN) / (TP + FP + TN + FN)$

**59) The Information Gain is used to**

- **select the attribute which maximises, for a given training set, the ability to predict the class value**
- select the attribute which maximises, for a given test set, the ability to predict the class value
- select the attribute which maximises, for a given training set, the ability to predict all the other attribute values
- select the class with maximum probability

**60) Which is the main reason for the MinMax scaling (also known as "rescaling") of attributes?**

- Change the distribution of the numeric attributes, in order to obtain gaussian distributions
- Map all the nominal attributes to the same range in order to prevent the values with higher frequency from having prevailing influence
- Remove abnormal values
- **Map all the numeric attributes to the same range, in order to prevent attributes with higher range from having prevalent influence**

**61) Which of the following is a base hypothesis for a bayesian classifier?**

- **The attributes must be statistically independent inside each class**
- The attributes must have negative correlation
- The attributes must be statistically independent
- The attributes must have zero correlation

**62) When developing a classifier, which of the following is a symptom of overfitting?**

- The error rate in the test set is much smaller than the error rate in the training set
- The precision is much greater than the recall
- The error rate in the test set is more than 30%
- **The error rate in the test set is much greater than the error rate in the training set**

**63) With reference to the total sum of squared errors and separation of a clustering scheme, which of the statements below is true?**

- They are two ways to measure the same thing
- They are strictly correlated, if, changing the clustering scheme, one increases, then the other does the same
- It is possible to optimise them (i.e. minimise SSE and maximise SSB) separately
- **They are strictly correlated, if, changing the clustering scheme, one increases, then the other decreases**

**64) How can we measure the quality of a trained regression model?**

- **With a formula elaborating the difference between the forecast values and the true ones**
- With a confusion matrix
- Counting the number of values correctly forecast
- With precision, recall and accuracy

**65) What is the coefficient of determination  $R^2$ ?**

- **Provide an index of goodness for a linear regression model**
- Measure the amount of error in a linear regression model
- Measure the amount of error in a regression model
- An index of goodness for a classification model

**66) What measure is maximised by the Expectation Maximisation algorithm for clustering?**

Scegli un'alternativa:

- **The likelihood the distributions, defined by the parameters found, given the data available**
- The likelihood of an example
- The support of a class
- The likelihood of an attribute, given the class label

**67) What is the difference between classification and regression?**

- **Classification has a categorical target, while regression has a numeric target**
- Classification is a supervised activity. while regression is unsupervised
- Classification can make errors, while regression is always exact
- Classification can have a numeric or categorical target, while regression has always a categorical target

**68) When is polynomial regression appropriate?**

- **When the relationship between the predicting variable and the target cannot be approximated as linear**
- When the target values are not linearly separable
- When there is more than one predicting attribute
- When it is necessary to project the data into a dimensional space

**69) How is the number of clusters determined in agglomerative clustering?**

- By assigning each data point to a cluster based on the final structure obtained from the dendrogram.
- **By cutting the dendrogram at a certain height.**
- By merging the closest clusters according to the defined distance metric.
- By computing the pairwise similarity or distance between all clusters.

**70) In data preprocessing, which of the operations below performs aggregation?**

- Combination of two attributes in order to obtain a more general attribute with smaller variability
- **Reduction of the number of distinct values of an attribute. in order to reduce its variability**
- **Reduction of the number of rows of the dataset by applying a grouping on one or more attributes and computing the measures as the results of aggregation functions**
- Combination of two or more datasets in order to obtain more information

**71) Match specific situations of data to the most appropriate pre-processing activity**

- The numeric attributes have very diverse ranges of values : **Rescaling**
- An attribute has a very skewed distribution (e.g. most of the values concentrated in a small range, and a very long tail of outliers): **Non linear transformations**
- A categorical attribute has a too large number of distinct values: **Aggregation**
- A nominal attribute needs to be used as predicting when using the sklearn library: **OneHot Encoding**

**72) What is the first step in agglomerative clustering? (NON VERIFICATA)**

Scegli un'alternativa:

- Cutting the Dendrogram: Decide on the number of clusters by cutting the dendrogram at a certain height
- Pairwise Cluster Similarity Calculation: Compute the pairwise similarity or distance between all clusters
- **Initialization: Start with each data point as a singleton cluster**
- Cluster Assignment: Assign each data point to a cluster based on the final structure obtained from the dendrogram

**73) Which of the following situations could suggest the use of MinMax scaling? (also known as "rescaling")**

- **There are numeric attributes with very diverse value ranges**
- There are attributes with very skewed data distributions
- There are attributes with a very large number of missing values
- There is a numeric attribute with values spread in a very large range