

# Databricks Certified Machine Learning Associate



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## Purpose of this Exam Guide

The purpose of this exam guide is to give you an overview of the exam and what is covered on the exam to help you determine your exam readiness. This document will get updated anytime there are any changes to an exam (and when those changes will take effect on an exam) so that you can be prepared. **This version covers the currently live version as of June 1, 2024. Please check back two weeks before you take your exam to make sure you have the most current version.**

## Audience Description

The Databricks Certified Machine Learning Associate certification exam assesses an individual's ability to use Databricks to perform basic machine learning tasks. This includes an ability to understand and use Databricks Machine Learning and its capabilities like AutoML, Feature Store, and select capabilities of MLflow. It also assesses the ability to make correct decisions in machine learning workflows and implement those workflows using Spark ML. Finally, an ability to understand advanced characteristics of scaling machine learning models is assessed. Individuals who pass this certification exam can be expected to complete basic machine learning tasks using Databricks and its associated tools.

## About the Exam

- Number of items: 45 multiple-choice questions
- Time limit: 90 minutes
- Registration fee: USD 200, plus applicable taxes as required per local law
- Delivery method: Online Proctored
- Test aides: None allowed.
- Prerequisite: None required; course attendance and six months of hands-on experience in Databricks is highly recommended
- Validity: 2 years
- Recertification: Recertification is required every two years to maintain your certified status. To recertify, you must take the full exam that is currently live. Please review the "Getting Ready for the Exam" section on the exam webpage to prepare for taking the exam again.
- Unscored Content: Exams may include unscored items to gather statistical information for future use. These items are not identified on the form and do not impact your score. Additional time is factored into account for this content.

## Recommended Training

- Instructor-led: [Machine Learning with Databricks](#)
- Self-paced (available in Databricks Academy): Machine Learning with Databricks

## Exam outline

### Section 1: Databricks Machine Learning

#### Databricks ML

- Identify when a standard cluster is preferred over a single-node cluster and vice versa
- Connect a repo from an external Git provider to Databricks repos.
- Commit changes from a Databricks Repo to an external Git provider.
- Create a new branch and commit changes to an external Git provider.
- Pull changes from an external Git provider back to a Databricks workspace.
- Orchestrate multi-task ML workflows using Databricks jobs.

#### Databricks Runtime for Machine Learning

- Create a cluster with the Databricks Runtime for Machine Learning.
- Install a Python library to be available to all notebooks that run on a cluster.

#### AutoML

- Identify the steps of the machine learning workflow completed by AutoML.
- Identify how to locate the source code for the best model produced by AutoML.
- Identify which evaluation metrics AutoML can use for regression problems.
- Identify the key attributes of the data set using the AutoML data exploration notebook.

#### Feature Store

- Describe the benefits of using Feature Store to store and access features for machine learning pipelines.
- Create a feature store table.
- Write data to a feature store table.
- Train a model with features from a feature store table.
- Score a model using features from a feature store table.

#### Managed MLflow

- Identify the best run using the MLflow Client API.
- Manually log metrics, artifacts, and models in an MLflow Run.
- Create a nested Run for deeper Tracking organization.
- Locate the time a run was executed in the MLflow UI.
- Locate the code that was executed with a run in the MLflow UI.
- Register a model using the MLflow Client API.

- Transition a model's stage using the Model Registry UI page.
- Transition a model's stage using the MLflow Client API.
- Request to transition a model's stage using the ML Registry UI page.

## Section 2: ML Workflows

### Exploratory Data Analysis

- Compute summary statistics on a Spark DataFrame using `.summary()`
- Compute summary statistics on a Spark DataFrame using `dbutils.data.summaries`.
- Remove outliers from a Spark DataFrame that are beyond or less than a designated threshold.

### Feature Engineering

- Identify why it is important to add indicator variables for missing values that have been imputed or replaced.
- Describe when replacing missing values with the mode value is an appropriate way to handle missing values.
- Compare and contrast imputing missing values with the mean value or median value.
- Impute missing values with the mean or median value.
- Describe the process of one-hot encoding categorical features.
- Describe why one-hot encoding categorical features can be inefficient for tree-based models.

### Training

- Perform random search as a method for tuning hyperparameters.
- Describe the basics of Bayesian methods for tuning hyperparameters.
- Describe why parallelizing sequential/iterative models can be difficult.
- Understand the balance between compute resources and parallelization.
- Parallelize the tuning of hyperparameters using Hyperopt and SparkTrials.
- Identify the usage of SparkTrials as the tool that enables parallelization for tuning single-node models.

### Evaluation and Selection

- Describe cross-validation and the benefits of downsides of using cross-validation over a train-validation split.
- Perform cross-validation as a part of model fitting.
- Identify the number of models being trained in conjunction with a grid-search and cross-validation process.
- Describe Recall and F1 as evaluation metrics.

- Identify the need to exponentiate the RMSE when the log of the label variable is used.
- Identify that the RMSE has not been exponentiated when the log of the label variable is used.

## **Section 3: Spark ML**

### **Distributed ML Concepts**

- Describe some of the difficulties associated with distributing machine learning models.
- Identify Spark ML as a key library for distributing traditional machine learning work.
- Identify scikit-learn as a single-node solution relative to Spark ML.

### **Spark ML Modeling APIs**

- Split data using Spark ML.
- Identify key gotchas when splitting distributed data using Spark ML.
- Train / evaluate a machine learning model using Spark ML.
- Describe Spark ML estimator and Spark ML transformer.
- Develop a Pipeline using Spark ML.
- Identify key gotchas when developing a Spark ML Pipeline.

### **Hyperopt**

- Identify Hyperopt as a solution for parallelizing the tuning of single-node models.
- Identify Hyperopt as a solution for Bayesian hyperparameter inference for distributed models.
- Parallelize the tuning of hyperparameters for Spark ML models using Hyperopt and Trials.
- Identify the relationship between the number of trials and model accuracy.

### **Pandas API on Spark**

- Describe key differences between Spark DataFrames and Pandas on Spark DataFrames.
- Identify the usage of an InternalFrame making Pandas API on Spark not quite as fast as native Spark.
- Identify Pandas API on Spark as a solution for scaling data pipelines without much refactoring.
- Convert data between a PySpark DataFrame and a Pandas on Spark DataFrame.
- Identify how to import and use the Pandas on Spark APIs.

### **Pandas UDFs/Function APIs**

- Identify Apache Arrow as the key to Pandas <-> Spark conversions.
- Describe why iterator UDFs are preferred for large data.
- Apply a model in parallel using a Pandas UDF.
- Identify that pandas code can be used inside of a UDF function.
- Train / apply group-specific models using the Pandas Function API.

## Section 4: Scaling ML Models

### Model Distribution

- Describe how Spark scales linear regression.
- Describe how Spark scales decision trees.

### Ensembling Distribution

- Describe the basic concepts of ensemble learning.
- Compare and contrast bagging, boosting, and stacking.

## Sample Questions

These questions are retired from a previous version of the exam. The purpose is to show you objectives as they are stated on the exam guide, and give you a sample question that aligns to the objective. The exam guide lists the objectives that could be covered on an exam. The best way to prepare for a certification exam is to review the exam outline in the exam guide.

### Question 1

*Objective: Create a new branch and commit changes to an external Git provider.*

A data scientist is developing a machine learning model. They made changes to their code in a text editor on their local machine, committed them to the project's Git repository, and pushed the changes to an online Git provider. Now, they want to load those changes into Databricks. The Databricks workspace contains an out-of-date version of the Git repository.

How can the data scientist complete this task?

- A. Open the Repo Git dialog and enable automatic syncing.
- B. Open the Repo Git dialog and click the "Sync" button.
- C. Open the Repo Git dialog and click the "Merge" button.
- D. Open the Repo Git dialog and enable automatic pulling.
- E. Open the Repo Git dialog and click the "Pull" button.

## Question 2

*Objective: Write data to a feature store table.*

A data scientist has computed updated rows that contain new feature values for primary keys already stored in the Feature Store table `features`. The updated feature values are stored in the DataFrame `features_df`. They want to update the rows in `features` if the associated primary key is in `features_df`. If a row's primary key is not in `features_df`, they want the row to remain unchanged in `features`.

Which code block using the Feature Store Client `fs` can be used to accomplish this task?

```
A. fs.write_table(  
    name="features",  
    df=features_df,  
    mode="merge"  
)
```

```
B. fs.write_table(  
    name="features",  
    df=features_df,  
    mode="overwrite"  
)
```

```
C. fs.write_table(  
    name="features",  
    df=features_df,  
)
```

```
D. fs.create_table(  
    name="features",  
    df=features_df,  
    mode="append"  
)
```

```
E. fs.refresh_table(  
    name="features",  
    df=features_df,  
    mode="overwrite"  
)
```

### Question 3

*Objective: Programmatically transition a model's stage.*

A senior machine learning engineer is developing a machine learning pipeline. They set up the pipeline to automatically transition a new version of a registered model to the Production stage in the Model Registry once it passes all tests using the MLflow Client API `client`.

Which operation was used to transition the model to the Production stage?

- A. `Client.update_model_stage`
- B. `client.transition_model_version_stage`
- C. `client.transition_model_version`
- D. `client.update_model_version`

### Question 4

*Objective: Make a Python library **newpackage** available in a given scenario.*

A machine learning team wants to use the Python library **newpackage** on all of their projects. They share a cluster for all of their projects.

Which approach makes the Python library **newpackage** available to all notebooks run on a cluster?

- A. Edit the cluster to use the Databricks Runtime for Machine Learning
- B. Set the `runtime-version` variable in their Spark session to "ml"
- C. Running `%pip install newpackage` once on any notebook attached to the cluster
- D. Adding `/databricks/python/bin/pip install newpackage` to the cluster's bash init script
- E. There is no way to make the **newpackage** library available on a cluster

### Question 5

*Objective: identify code blocks for computing the accuracy of a model.*

A data scientist has developed a two-class decision tree classifier using Spark ML and computed the predictions in a Spark DataFrame `preds_df` with the following schema:

```
prediction DOUBLE
actual DOUBLE
```

Which of the following code blocks can be used to compute the accuracy of the model according

to the data in `preds_df` and assign it to the `accuracy` variable?

- A. 

```
accuracy = RegressionEvaluator(  
    predictionCol="prediction",  
    labelCol="actual",  
    metricName="accuracy"  
)
```
- B. 

```
accuracy = MulticlassClassificationEvaluator(  
    predictionCol="prediction",  
    labelCol="actual",  
    metricName="accuracy"  
)  
accuracy = classification_evaluator.evaluate(preds_df)
```
- C. 

```
classification_evaluator = BinaryClassificationEvaluator(  
    predictionCol="prediction",  
    labelCol="actual",  
    metricName="accuracy"  
)
```
- D. 

```
accuracy = Summarizer(  
    predictionCol="prediction",  
    labelCol="actual",  
    metricName="accuracy"  
)
```
- E. 

```
classification_evaluator = BinaryClassificationEvaluator(  
    predictionCol="prediction",  
    labelCol="actual",  
    metricName="accuracy"  
)  
accuracy = classification_evaluator.evaluate(preds_df)
```

Answers:

Question 1: E

Question 2: A

Question 3: B

Question 4: D

Question 5: E



