DP-203 Resources

1. **Design and Implement Data Storage (40-45%)**
   1. Design a data storage structure
      1. design an Azure Data Lake solution
         1. <https://docs.microsoft.com/en-us/azure/storage/blobs/data-lake-storage-best-practices>
         2. <https://docs.microsoft.com/en-us/azure/storage/blobs/data-lake-storage-data-scenarios>
      2. recommend file types for storage &
      3. recommend file types for analytical queries
         1. <https://docs.microsoft.com/en-us/azure/data-factory/connector-azure-data-lake-storage#dataset-properties>
      4. design for efficient querying
         1. <https://docs.microsoft.com/en-us/azure/data-explorer/data-lake-query-data#optimize-your-query-performance>
         2. <https://docs.microsoft.com/en-us/azure/storage/blobs/data-lake-storage-query-acceleration>
         3. <https://docs.microsoft.com/en-us/azure/storage/blobs/data-lake-storage-query-acceleration-how-to?tabs=azure-powershell%2Cpowershell>
      5. design for data pruning
         1. <https://en.wikipedia.org/wiki/Decision_tree_pruning>
         2. <https://docs.microsoft.com/en-us/azure/storage/blobs/data-lake-storage-performance-tuning-guidance>
         3. <https://docs.microsoft.com/bs-cyrl-ba/azure/databricks//delta/optimizations/dynamic-file-pruning>
         4. <https://databricks.com/blog/2020/04/30/faster-sql-queries-on-delta-lake-with-dynamic-file-pruning.html>
         5. https://docs.microsoft.com/en-ca/azure/databricks//delta/optimizations/dynamic-file-pruning
      6. design a folder structure that represents the levels of data transformation
         1. <https://docs.microsoft.com/en-us/azure/storage/blobs/data-lake-storage-best-practices#directory-layout-considerations>
         2. <https://techcommunity.microsoft.com/t5/data-architecture-blog/how-to-organize-your-data-lake/ba-p/1182562>
         3. <https://docs.microsoft.com/en-us/azure/storage/blobs/data-lake-storage-namespace>
      7. design a distribution strategy
         1. <https://docs.microsoft.com/en-us/azure/synapse-analytics/sql-data-warehouse/sql-data-warehouse-tables-distribute>
      8. design a data archiving solution
         1. <https://azure.microsoft.com/en-ca/updates/archive-tier-for-azure-data-lake-storage-now-generally-available/>
         2. https://docs.microsoft.com/en-us/azure/storage/blobs/storage-blob-storage-tiers?tabs=azure-portal#archive-access-tier
   2. Design a partition strategy
      1. design a partition strategy for files
      2. design a partition strategy for analytical workloads
      3. design a partition strategy for efficiency/performance
      4. design a partition strategy for Azure Synapse Analytics
      5. identify when partitioning is needed in Azure Data Lake Storage Gen2
         1. <https://docs.microsoft.com/en-us/azure/architecture/best-practices/data-partitioning>
         2. <https://docs.microsoft.com/en-us/azure/architecture/best-practices/data-partitioning-strategies>
   3. Design the serving layer
      1. design star schemas
         1. <https://docs.microsoft.com/en-us/power-bi/guidance/star-schema>
         2. <https://docs.microsoft.com/en-us/azure/synapse-analytics/sql-data-warehouse/sql-data-warehouse-tables-overview>
      2. design slowly changing dimensions
         1. <https://en.wikipedia.org/wiki/Slowly_changing_dimension>
         2. <https://docs.microsoft.com/en-us/learn/modules/populate-slowly-changing-dimensions-azure-synapse-analytics-pipelines/>
         3. https://docs.microsoft.com/en-us/learn/modules/populate-slowly-changing-dimensions-azure-synapse-analytics-pipelines/3-choose-between-dimension-types
         4. <https://docs.microsoft.com/en-us/learn/modules/populate-slowly-changing-dimensions-azure-synapse-analytics-pipelines/2-describe>
         5. https://www.youtube.com/watch?v=Sg2AAk1vwEs
      3. design a dimensional hierarchy
         1. https://docs.microsoft.com/en-us/power-bi/guidance/star-schema#snowflake-dimensions
         2. <https://en.wikipedia.org/wiki/Snowflake_schema>
         3. https://docs.microsoft.com/en-us/azure/data-factory/connector-snowflake
      4. design a solution for temporal data
         1. https://docs.microsoft.com/en-us/azure/azure-sql/temporal-tables
         2. https://en.wikipedia.org/wiki/Temporal\_database
      5. design for incremental loading
         1. <https://docs.microsoft.com/en-us/azure/data-factory/tutorial-incremental-copy-overview>
         2. <https://docs.microsoft.com/en-us/azure/data-factory/tutorial-incremental-copy-change-tracking-feature-portal>
         3. <https://docs.microsoft.com/en-us/azure/data-factory/tutorial-incremental-copy-portal>
         4. <https://www.youtube.com/watch?v=F9cBFnxaSGI>
      6. design analytical stores
         1. <https://docs.microsoft.com/en-us/azure/architecture/data-guide/technology-choices/analytical-data-stores>
         2. <https://docs.microsoft.com/en-us/azure/architecture/data-guide/big-data/#lambda-architecture>
      7. design metastores in Azure Synapse Analytics and Azure Databricks
         1. <https://docs.microsoft.com/en-us/azure/hdinsight/hdinsight-use-external-metadata-stores>
         2. https://docs.microsoft.com/en-us/azure/databricks/data/metastore/
         3. <https://docs.microsoft.com/en-us/azure/synapse-analytics/metadata/overview>
         4. <https://docs.microsoft.com/en-us/azure/databricks/data/metastores/external-hive-metastore>
         5. https://www.youtube.com/watch?v=pBB5zFnhgyE&list=PL7\_h0bRfL52oZqAfV\_kumYLUH5dbcWm9q
   4. Implement physical data storage structures
      1. implement compression
         1. <https://docs.microsoft.com/en-us/azure/data-factory/supported-file-formats-and-compression-codecs>
         2. <https://docs.microsoft.com/en-us/azure/data-factory/format-parquet>
         3. https://databricks.com/glossary/what-is-parquet
         4. <https://docs.informatica.com/data-integration/powerexchange-adapters-for-informatica/10-5/powerexchange-for-microsoft-azure-blob-storage-user-guide/microsoft-azure-blob-storage-data-objects/data-compression-in-microsoft-azure-blob-storage-sources-and-tar.html>
      2. implement partitioning
         1. <https://docs.microsoft.com/en-us/azure/synapse-analytics/sql-data-warehouse/sql-data-warehouse-tables-partition>
      3. implement sharding
         1. <https://docs.microsoft.com/en-us/azure/architecture/patterns/sharding>
         2. <https://docs.microsoft.com/en-us/azure/azure-sql/database/elastic-scale-introduction>
         3. <https://docs.microsoft.com/en-us/azure/azure-sql/database/elastic-scale-shard-map-management>
      4. implement different table geometries with Azure Synapse Analytics pools
         1. <https://docs.microsoft.com/en-us/azure/synapse-analytics/get-started-analyze-sql-pool>
         2. <https://docs.microsoft.com/en-us/azure/synapse-analytics/get-started-analyze-sql-on-demand>
         3. <https://docs.microsoft.com/en-us/azure/synapse-analytics/get-started-analyze-spark>
      5. implement data redundancy
         1. <https://docs.microsoft.com/en-us/azure/synapse-analytics/sql-data-warehouse/backup-and-restore>
         2. <https://docs.microsoft.com/en-us/azure/cloud-adoption-framework/migrate/azure-best-practices/analytics/azure-synapse>
         3. <https://docs.microsoft.com/en-us/azure/storage/common/storage-redundancy>
         4. https://docs.microsoft.com/en-us/azure/databricks/scenarios/howto-regional-disaster-recovery
      6. implement distributions
         1. <https://docs.microsoft.com/en-us/azure/synapse-analytics/sql-data-warehouse/sql-data-warehouse-tables-distribute>
      7. implement data archiving
         1. <https://docs.microsoft.com/en-us/azure/synapse-analytics/sql-data-warehouse/backup-and-restore>
         2. <https://docs.microsoft.com/en-us/azure/storage/blobs/data-lake-storage-supported-blob-storage-features>
            1. https://docs.microsoft.com/en-us/azure/storage/blobs/storage-blob-storage-tiers
   5. Implement logical data structures
      1. build a temporal data solution
         1. <https://docs.microsoft.com/en-us/azure/azure-sql/temporal-tables>
         2. <https://docs.microsoft.com/en-us/azure/architecture/>
      2. build external tables
         1. <https://docs.microsoft.com/en-us/azure/synapse-analytics/sql/develop-tables-external-tables?tabs=hadoop>
      3. implement file and folder structures for efficient querying and data pruning
         1. <https://docs.microsoft.com/en-us/azure/data-explorer/data-lake-query-data>
         2. <https://docs.microsoft.com/en-us/azure/storage/blobs/data-lake-storage-performance-tuning-guidance>
   6. Implement the serving layer
      1. deliver data in a relational star schema
         1. <https://docs.microsoft.com/en-us/azure/synapse-analytics/sql/develop-tables-overview>
         2. <https://en.wikipedia.org/wiki/Star_schema>
      2. deliver data in Parquet files
         1. <https://databricks.com/glossary/what-is-parquet>
         2. <https://docs.microsoft.com/en-us/azure/data-factory/format-parquet>
      3. implement a dimensional hierarchy
         1. https://docs.microsoft.com/en-us/power-bi/guidance/star-schema#snowflake-dimensions
         2. <https://en.wikipedia.org/wiki/Snowflake_schema>
         3. https://docs.microsoft.com/en-us/azure/data-factory/connector-snowflake
2. **Design and Develop Data Processing (25-30%)**
   1. Ingest and transform data
      1. transform data by using Apache Spark
         1. <https://docs.microsoft.com/en-us/azure/databricks/scenarios/databricks-extract-load-sql-data-warehouse>
      2. transform data by using Transact-SQL
         1. <https://docs.microsoft.com/en-us/azure/data-factory/connector-azure-sql-data-warehouse>
      3. transform data by using Data Factory
         1. <https://docs.microsoft.com/en-us/azure/data-factory/connector-azure-sql-database>
         2. <https://docs.microsoft.com/en-us/azure/data-factory/transform-data-using-spark>
      4. transform data by using Azure Synapse Pipelines
         1. <https://docs.microsoft.com/en-us/azure/synapse-analytics/get-started-pipelines>
         2. <https://docs.microsoft.com/en-us/azure/data-factory/concepts-pipelines-activities?toc=/azure/synapse-analytics/toc.json&bc=/azure/synapse-analytics/breadcrumb/toc.json>
      5. transform data by using Stream Analytics
         1. <https://docs.microsoft.com/en-us/azure/stream-analytics/stream-analytics-introduction>
      6. cleanse data
         1. <https://en.wikipedia.org/wiki/Data_cleansing>
         2. <https://www.sqlshack.com/data-cleansing-in-azure-machine-learning/>
         3. <https://app.pluralsight.com/guides/cleaning-data-with-azure-ml-studio>
         4. <https://docs.microsoft.com/en-us/azure/machine-learning/algorithm-module-reference/clean-missing-data>
      7. split data
         1. <https://docs.microsoft.com/en-us/azure/machine-learning/algorithm-module-reference/split-data>
      8. shred JSON
         1. <https://docs.microsoft.com/en-us/sql/relational-databases/json/convert-json-data-to-rows-and-columns-with-openjson-sql-server?view=sql-server-ver15>
         2. <https://docs.microsoft.com/en-us/sql/t-sql/functions/openjson-transact-sql?view=sql-server-ver15>
      9. encode and decode data
         1. <https://docs.microsoft.com/en-us/answers/questions/129474/azure-data-factory-base64-encoded-secrets.html>
      10. configure error handling for the transformation
          1. <https://docs.microsoft.com/en-us/azure/data-factory/how-to-data-flow-error-rows>
          2. <https://techcommunity.microsoft.com/t5/azure-data-factory/understanding-pipeline-failures-and-error-handling/ba-p/1630459>
          3. <https://docs.microsoft.com/en-us/azure/data-factory/data-factory-ux-troubleshoot-guide>
          4. <https://docs.microsoft.com/en-us/azure/data-factory/monitor-using-azure-monitor>
      11. normalize and denormalize values
          1. <https://docs.microsoft.com/en-us/azure/machine-learning/algorithm-module-reference/normalize-data>
      12. transform data by using Scala
          1. <https://docs.microsoft.com/en-us/azure/databricks/scenarios/databricks-extract-load-sql-data-warehouse>
      13. perform data exploratory analysis
          1. <https://azure.microsoft.com/en-us/resources/videos/perform-exploratory-analytics-over-your-data-lake/>
          2. <https://docs.microsoft.com/en-us/learn/modules/perform-machine-learning-with-azure-databricks/>
   2. Design and develop a batch processing solution
      1. develop batch processing solutions by using Data Factory, Data Lake, Spark, Azure
         1. <https://docs.microsoft.com/en-us/azure/data-factory/v1/data-factory-data-processing-using-batch>
         2. <https://docs.microsoft.com/en-us/azure/architecture/data-guide/technology-choices/batch-processing>
      2. Synapse Pipelines, PolyBase, and Azure Databricks &
      3. create data pipelines
         1. <https://docs.microsoft.com/en-us/sql/relational-databases/polybase/polybase-versioned-feature-summary?view=sql-server-ver15>
         2. <https://docs.microsoft.com/en-us/azure/databricks/clusters/configure>
         3. https://www.youtube.com/watch?v=JUQXx0R0RfE
      4. design and implement incremental data loads
         1. <https://docs.microsoft.com/en-us/azure/data-factory/tutorial-incremental-copy-overview>
      5. design and develop slowly changing dimensions
         1. <https://docs.microsoft.com/en-us/learn/modules/populate-slowly-changing-dimensions-azure-synapse-analytics-pipelines/>
         2. https://docs.microsoft.com/en-us/learn/modules/populate-slowly-changing-dimensions-azure-synapse-analytics-pipelines/3-choose-between-dimension-types
         3. https://docs.microsoft.com/en-us/learn/modules/populate-slowly-changing-dimensions-azure-synapse-analytics-pipelines/2-describe
      6. handle security and compliance requirements
         1. <https://azure.microsoft.com/en-ca/overview/trusted-cloud/compliance/>
         2. <https://docs.microsoft.com/en-ca/azure/compliance/>
      7. scale resources
         1. <https://docs.microsoft.com/en-us/azure/synapse-analytics/sql-data-warehouse/quickstart-scale-compute-portal>
         2. <https://docs.microsoft.com/en-us/azure/data-factory/copy-activity-performance>
      8. configure the batch size
         1. <https://docs.microsoft.com/en-us/azure/batch/batch-automatic-scaling>
         2. https://docs.microsoft.com/en-us/azure/databricks/delta/delta-batch
      9. design and create tests for data pipelines
         1. <https://docs.microsoft.com/en-us/azure/databricks/dev-tools/ci-cd/ci-cd-azure-devops>
      10. integrate Jupyter/IPython notebooks into a data pipeline
          1. https://docs.microsoft.com/en-us/azure/databricks/notebooks/
          2. https://docs.microsoft.com/en-us/azure/databricks/notebooks/notebooks-use
          3. https://docs.microsoft.com/en-us/azure/databricks/notebooks/notebooks-manage
      11. handle duplicate data
          1. https://docs.microsoft.com/en-us/azure/data-factory/how-to-data-flow-dedupe-nulls-snippets
      12. handle missing data &
      13. handle late-arriving data
          1. <https://docs.microsoft.com/en-us/azure/stream-analytics/stream-analytics-time-handling>
          2. <https://docs.microsoft.com/en-us/azure/stream-analytics/stream-analytics-solution-patterns>
          3. <https://docs.microsoft.com/en-us/azure/machine-learning/algorithm-module-reference/clean-missing-data>
          4. <https://learning.oreilly.com/library/view/stream-analytics-with/9781788395908/0b61b6d7-d805-42e2-a1cf-24148ce07f47.xhtml>
          5. <https://docs.microsoft.com/en-us/azure/stream-analytics/event-ordering>
      14. upsert data
          1. <https://docs.microsoft.com/en-us/azure/data-factory/data-flow-alter-row>
      15. regress to a previous state
          1. <https://docs.microsoft.com/en-us/answers/questions/31313/transactions-in-adf.html>
          2. <https://docs.microsoft.com/en-us/azure/data-factory/connector-azure-sql-data-warehouse>
      16. design and configure exception handling
          1. <https://docs.microsoft.com/en-us/azure/data-factory/how-to-data-flow-error-rows>
      17. configure batch retention
          1. [Configure a simple Azure Batch Job with Azure Data Factory - Microsoft Tech Community](https://techcommunity.microsoft.com/t5/azure-paas-blog/configure-a-simple-azure-batch-job-with-azure-data-factory/ba-p/2260759)
      18. design a batch processing solution
          1. <https://docs.microsoft.com/en-us/azure/data-factory/v1/data-factory-data-processing-using-batch>
      19. debug Spark jobs by using the Spark UI
          1. <https://docs.microsoft.com/en-us/azure/hdinsight/spark/apache-spark-job-debugging>
   3. **Design and develop a stream processing solution**
      1. develop a stream processing solution by using Stream Analytics, Azure Databricks, and Azure Event Hubs
         1. <https://docs.microsoft.com/en-us/azure/stream-analytics/stream-analytics-introduction>
         2. <https://docs.microsoft.com/en-us/azure/databricks/spark/latest/structured-streaming/>
         3. <https://docs.microsoft.com/en-us/azure/architecture/reference-architectures/data/stream-processing-databricks>
      2. process data by using Spark structured streaming
         1. <https://docs.microsoft.com/en-us/azure/databricks/spark/latest/structured-streaming/>
      3. monitor for performance and functional regressions
         1. <https://docs.microsoft.com/en-us/azure/databricks/kb/jobs/job-run-dash>
         2. <https://docs.microsoft.com/en-us/azure/data-factory/concepts-data-flow-monitoring>
      4. design and create windowed aggregates
         1. <https://docs.microsoft.com/en-us/azure/stream-analytics/stream-analytics-window-functions>
      5. handle schema drift
         1. <https://docs.microsoft.com/en-us/azure/data-factory/concepts-data-flow-schema-drift>
      6. process time series data
         1. <https://azure-samples.github.io/azureiotlabs/timeseriesinsights/#:~:text=Azure%20Time%20Series%20Insights%20is,over%20the%20world%20in%20seconds.>
         2. https://docs.microsoft.com/en-ca/azure/time-series-insights/
      7. process within one partition
      8. process across partitions
         1. <https://docs.microsoft.com/en-us/azure/architecture/reference-architectures/event-hubs/partitioning-in-event-hubs-and-kafka>
         2. <https://docs.microsoft.com/en-us/azure/event-hubs/event-hubs-features#partitions>
         3. <https://docs.microsoft.com/en-us/azure/stream-analytics/repartition>
         4. <https://docs.microsoft.com/en-us/azure/stream-analytics/stream-analytics-parallelization>
      9. configure checkpoints/watermarking during processing
         1. <https://docs.microsoft.com/en-us/azure/stream-analytics/stream-analytics-time-handling>
      10. scale resources
          1. <https://docs.microsoft.com/en-us/azure/stream-analytics/stream-analytics-scale-jobs>
      11. handle interruptions
          1. <https://docs.microsoft.com/en-us/azure/stream-analytics/stream-analytics-job-reliability>
          2. <https://docs.microsoft.com/en-us/azure/stream-analytics/stream-analytics-time-handling>
      12. design and configure exception handling
          1. <https://docs.microsoft.com/en-us/azure/stream-analytics/stream-analytics-output-error-policy>
          2. <https://docs.microsoft.com/en-us/azure/stream-analytics/configuration-error-codes>
      13. upsert data
          1. <https://docs.microsoft.com/en-us/azure/stream-analytics/stream-analytics-documentdb-output>
      14. replay archived stream data
          1. <https://docs.microsoft.com/en-us/azure/stream-analytics/stream-analytics-concepts-checkpoint-replay>
      15. design a stream processing solution
          1. <https://docs.microsoft.com/en-us/azure/architecture/reference-architectures/data/stream-processing-stream-analytics>
   4. Manage batches and pipelines
      1. trigger batches
      2. handle failed batch loads
         1. <https://docs.microsoft.com/en-us/azure/batch/error-handling>
         2. <https://docs.microsoft.com/en-us/azure/batch/batch-job-task-error-checking>
         3. <https://docs.microsoft.com/en-us/azure/batch/batch-pool-node-error-checking>
         4. <https://docs.microsoft.com/en-us/azure/batch/best-practices>
      3. validate batch loads
         1. <https://docs.microsoft.com/en-us/azure/batch/batch-job-task-error-checking>
      4. manage data pipelines in Data Factory/Synapse Pipelines
      5. schedule data pipelines in Data Factory/Synapse Pipelines
         1. <https://docs.microsoft.com/en-us/azure/synapse-analytics/get-started-pipelines>
         2. <https://docs.microsoft.com/en-us/azure/data-factory/concepts-pipelines-activities>
      6. implement version control for pipeline artifacts
         1. <https://docs.microsoft.com/en-us/azure/data-factory/source-control>
      7. manage Spark jobs in a pipeline
         1. <https://docs.microsoft.com/en-us/azure/data-factory/v1/data-factory-spark>
3. **Design and Implement Data Security (10-15%)**
   1. Design security for data policies and standards
      1. design data encryption for data at rest and in transit
         1. <https://docs.microsoft.com/en-us/azure/storage/common/storage-service-encryption>
         2. <https://docs.microsoft.com/en-us/azure/cosmos-db/database-encryption-at-rest>
         3. <https://docs.microsoft.com/en-us/azure/synapse-analytics/security/workspaces-encryption>
         4. <https://docs.microsoft.com/en-us/azure/security/fundamentals/encryption-atrest>
      2. design a data auditing strategy
         1. <https://docs.microsoft.com/en-us/azure/azure-sql/database/auditing-overview>
         2. https://docs.microsoft.com/en-us/azure/cosmos-db/audit-control-plane-logs
      3. design a data masking strategy, design for data privacy
         1. <https://docs.microsoft.com/en-us/azure/security/fundamentals/protection-customer-data>
         2. https://docs.microsoft.com/en-us/azure/azure-sql/database/dynamic-data-masking-overview
      4. design a data retention policy
         1. <https://docs.microsoft.com/en-us/azure/storage/blobs/storage-lifecycle-management-concepts?tabs=azure-portal>
         2. <https://docs.microsoft.com/en-us/azure/azure-monitor/logs/manage-cost-storage>
         3. <https://docs.microsoft.com/en-us/azure/azure-monitor/app/data-retention-privacy>
         4. <https://azure.microsoft.com/en-ca/updates/retention-by-type/>
      5. design to purge data based on business requirements
         1. <https://docs.microsoft.com/en-us/azure/storage/blobs/soft-delete-blob-overview>
         2. <https://docs.microsoft.com/en-us/rest/api/keyvault/purgedeletedstorageaccount/purgedeletedstorageaccount>
         3. <https://docs.microsoft.com/en-us/azure/data-explorer/kusto/concepts/data-purge>
         4. https://docs.microsoft.com/en-us/azure/storage/blobs/soft-delete-blob-enable
      6. design Azure role-based access control (Azure RBAC) and POSIX-like Access Control List
         1. <https://docs.microsoft.com/en-us/azure/storage/blobs/data-lake-storage-access-control-model>
      7. (ACL) for Data Lake Storage Gen2
         1. <https://docs.microsoft.com/en-us/azure/storage/blobs/data-lake-storage-access-control>
      8. Design and implement row-level and column-level security
         1. <https://docs.microsoft.com/en-us/sql/relational-databases/security/row-level-security?view=sql-server-ver15>
         2. <https://docs.microsoft.com/en-us/azure/synapse-analytics/sql-data-warehouse/column-level-security>
   2. Implement data security
      1. implement data masking
         1. <https://docs.microsoft.com/en-us/azure/azure-sql/database/dynamic-data-masking-overview>
      2. implement Azure RBAC
         1. <https://docs.microsoft.com/en-us/azure/storage/blobs/data-lake-storage-access-control-model>
      3. implement POSIX-like ACLs for Data Lake Storage Gen2
         1. <https://docs.microsoft.com/en-us/azure/storage/blobs/data-lake-storage-access-control>
      4. implement a data retention policy
         1. <https://azure.microsoft.com/en-ca/updates/lifecycle-management-for-azure-data-lake-storage-is-now-generally-available/>
         2. <https://docs.microsoft.com/en-us/azure/storage/blobs/storage-lifecycle-management-concepts?tabs=azure-portal>
      5. implement a data auditing strategy
         1. <https://docs.microsoft.com/en-us/azure/data-lake-analytics/data-lake-analytics-diagnostic-logs>
      6. manage identities, keys, and secrets across different data platform technologies
         1. <https://docs.microsoft.com/en-us/rest/api/storageservices/authorize-with-shared-key>
         2. <https://docs.microsoft.com/en-us/azure/storage/common/storage-sas-overview?toc=/azure/storage/blobs/toc.json>
         3. <https://docs.microsoft.com/en-us/azure/storage/blobs/data-lake-storage-access-control-model>
      7. implement secure endpoints (private and public)
         1. <https://docs.microsoft.com/en-us/azure/private-link/private-endpoint-overview>
         2. <https://docs.microsoft.com/en-us/azure/storage/blobs/data-lake-storage-best-practices>
         3. <https://docs.microsoft.com/en-us/azure/data-factory/data-movement-security-considerations>
      8. implement resource tokens in Azure Databricks
         1. <https://docs.microsoft.com/en-us/azure/databricks/administration-guide/access-control/tokens>
         2. <https://docs.microsoft.com/en-us/azure/databricks/dev-tools/api/latest/aad/service-prin-aad-token>
      9. load a Data Frame with sensitive information &
      10. write encrypted data to tables or Parquet files &
      11. manage sensitive information
          1. <https://databricks.com/blog/2020/11/20/enforcing-column-level-encryption-and-avoiding-data-duplication-with-pii.html>
          2. <https://databricks.com/session_na20/encryption-and-masking-for-sensitive-apache-spark-analytics-addressing-ccpa-and-governance>
4. **Monitor and Optimize Data Storage and Data Processing (10-15%)**
   1. Monitor data storage and data processing
      1. implement logging used by Azure Monitor
         1. <https://docs.microsoft.com/en-us/azure/azure-monitor/logs/data-platform-logs>
      2. configure monitoring services
         1. <https://docs.microsoft.com/en-us/azure/azure-monitor/deploy>
      3. measure performance of data movement
         1. <https://docs.microsoft.com/en-us/azure/azure-sql/database/monitoring-with-dmvs>
      4. monitor and update statistics about data across a system
      5. monitor data pipeline performance
         1. <https://docs.microsoft.com/en-us/azure/data-factory/monitor-using-azure-monitor>
      6. measure query performance
         1. <https://docs.microsoft.com/en-us/azure/azure-sql/database/query-performance-insight-use>
      7. monitor cluster performance
         1. <https://docs.microsoft.com/en-us/azure/hdinsight/hdinsight-key-scenarios-to-monitor>
         2. <https://docs.microsoft.com/en-us/azure/synapse-analytics/monitoring/how-to-monitor-using-azure-monitor>
         3. <https://docs.microsoft.com/en-us/azure/architecture/databricks-monitoring/>
      8. understand custom logging options
         1. <https://docs.microsoft.com/en-us/azure/azure-monitor/agents/data-sources-custom-logs>
      9. schedule and monitor pipeline tests
      10. interpret Azure Monitor metrics and logs
          1. <https://docs.microsoft.com/en-us/azure/azure-monitor/essentials/data-platform-metrics>
      11. interpret a Spark directed acyclic graph (DAG)
   2. Optimize and troubleshoot data storage and data processing
      1. compact small files
      2. rewrite user-defined functions (UDFs)
      3. handle skew in data
         1. <https://en.wikipedia.org/wiki/Skewness>
         2. <https://docs.microsoft.com/en-us/azure/synapse-analytics/sql-data-warehouse/sql-data-warehouse-tables-distribute#choose-a-distribution-column-with-data-that-distributes-evenly>
         3. <https://docs.microsoft.com/en-us/azure/synapse-analytics/sql-data-warehouse/sql-data-warehouse-tables-distribute#determine-if-the-table-has-data-skew>
      4. handle data spill
         1. <https://en.wikipedia.org/wiki/Data_breach>
         2. <https://docs.microsoft.com/en-us/compliance/regulatory/gdpr-breach-notification>
         3. <https://docs.microsoft.com/en-us/compliance/regulatory/gdpr-breach-azure-dynamics>
      5. tune shuffle partitions
         1. <https://docs.microsoft.com/en-us/azure/architecture/databricks-monitoring/performance-troubleshooting>
      6. find shuffling in a pipeline
      7. optimize resource management
      8. tune queries by using indexers
         1. <https://docs.microsoft.com/en-us/azure/azure-sql/database/automatic-tuning-overview>
         2. <https://docs.microsoft.com/en-us/sql/relational-databases/automatic-tuning/automatic-tuning?view=sql-server-ver15>
      9. tune queries by using cache
         1. <https://docs.microsoft.com/en-us/azure/synapse-analytics/sql-data-warehouse/performance-tuning-result-set-caching>
      10. optimize pipelines for analytical or transactional purposes
      11. optimize pipeline for descriptive versus analytical workloads
      12. troubleshoot a failed spark job
          1. <https://docs.microsoft.com/en-us/azure/databricks/kb/jobs/>
          2. <https://docs.microsoft.com/en-us/azure/hdinsight/spark/apache-spark-known-issues>
          3. <https://docs.microsoft.com/en-us/azure/data-factory/data-factory-troubleshoot-guide>
      13. troubleshoot a failed pipeline run
          1. https://docs.microsoft.com/en-us/azure/data-factory/data-factory-troubleshoot-guide