

# TPC Express Benchmark™ AI Full Disclosure Report

## PowerEdge R6625

with 1x PowerEdge R6625  
using

### Anaconda Pro

running on

## Red Hat Enterprise Linux 8.6 (Ootpa)

TPCx-AI Version  
Report Edition  
Report Submitted

1.0.3.1  
First  
September 25, 2023

**First Edition - September 2023**

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# Abstract

Dell conducted the TPC Express Benchmark™ AI (TPCx-AI) on the PowerEdge R6625. The software used included Anaconda Pro. This report provides full disclosure of the results. All testing was conducted in conformance with the requirements of the TPCx-AI Standard Specification, Revision 1.0.3.1.

## Configuration Overview


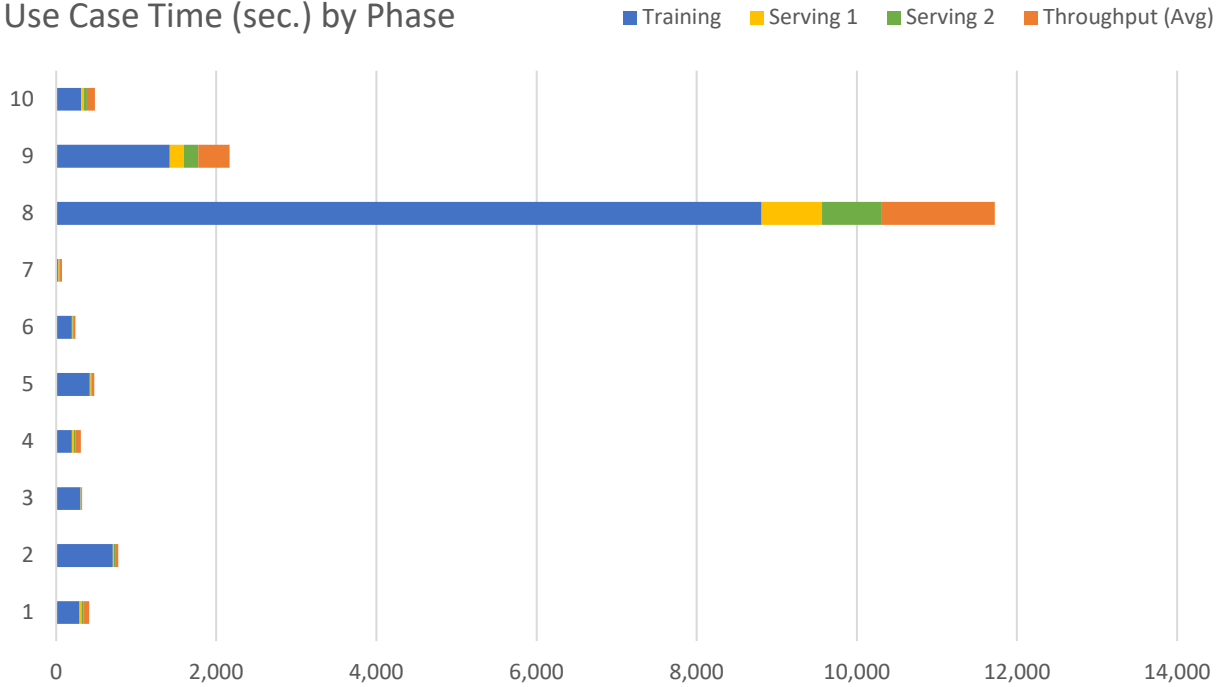
| Test Sponsor | Node(s)                     | Operating System                     |
|--------------|-----------------------------|--------------------------------------|
| Dell         | 1x PowerEdge R6625 (Server) | Red Hat Enterprise Linux 8.6 (Ootpa) |


## Metrics Overview


| Total System Cost | Performance      | Price/Performance      | Availability Date  |
|-------------------|------------------|------------------------|--------------------|
| \$44,248 USD      | 915.67 AIUCpm@30 | 48.33 USD \$/AIUCpm@30 | September 25, 2023 |

# Executive Summary

The [Executive Summary](#) follows on the next several pages.

|   |   |   |  |   |
|---|---|---|--|---|
|    |   | <h1>PowerEdge R6625</h1>                          |  | TPCx-AI 1.0.3.1<br>TPC Pricing 2.8.0<br>Report Date Sep. 25, 2023 |
| TPCx-AI Performance<br><b>915.67 AIUCpm@30</b>  | Total System Cost<br><b>\$44,248 USD</b>  | Price/Performance<br><b>\$48.33 USD/AIUCpm@30</b> | Availability Date<br><b>September 25, 2023</b> |   |
| Framework<br>Anaconda Pro   | Operating System<br>Red Hat Enterprise Linux 8.6 (Ootpa)  | Other Software<br>N/A                             | Scale Factor<br>30                             | Streams<br>100  |
| <div style="display: flex; justify-content: space-between;"> <div> <h3>Use Case Time (sec.) by Phase</h3>  </div> <div> <p>■ Training ■ Serving 1 ■ Serving 2 ■ Throughput (Avg)</p> </div> </div> |   |   |  |   |
| Physical Storage / Scale Factor<br><b>32.00</b>   | Scale Factor / Physical Memory<br><b>0.04</b>   | Main Data Redundancy Model<br><b>RAID 1</b>       |  |   |
| Servers:<br>Total Processors/Cores/Threads  | 1<br>2 / 64 / 128   |   |  |   |
| Server Type<br>Processors<br>Memory<br>Storage Controller<br>Storage Device<br>Network Controller   | 1x PowerEdge R6625 (Server)<br>2x AMD EPYC 9374F 32-Core Processor GHz<br>768 GiB<br>1x Dell BOSS-N1<br>2x 480 GB M.2 NVMe SSD<br>1x Broadcom NetXtreme BCM5720 Dual Port 1 GbE |   |  |   |

|    |             | <h1>PowerEdge R6625</h1>   |                 |     | TPCx-AI 1.0.3.1<br>TPC Pricing 2.8.0<br>Report Date Sep. 25, 2023 |                   |
|---|-------------|--|-----------------|-----|---|-------------------|
| Description   | Part Number | Source   | List Price      | Qty | Extended Price  | 1-Yr. Maintenance |
| <b>Hardware</b>   |             |  |                 |     |   |                   |
| PowerEdge R6625 Server  | 210-BFXO    |  | \$85,799.82     | 1   | \$85,799.82   |                   |
| 2.5 Chassis   | 379-BDTF    |  | \$0.00          | 1   |   |                   |
| SAS/SATA/NVMe Capable Backplane   | 379-BDSW    |  | \$0.00          | 1   |   |                   |
| No Rear Storage   | 379-BDTE    |  | \$0.00          | 1   |   |                   |
| No GPU Enablement   | 379-BDSR    |  | \$0.00          | 1   |   |                   |
| Trusted Platform Module 2.0 V3  | 461-AAIG    |  | \$0.00          | 1   |   |                   |
| 2.5" Chassis with 8 Universal Drive Slots (SAS/SATA/NVME), Front PERC 11  | 321-BKGR    |  | \$0.00          | 1   |   |                   |
| AMD EPYC 9374F 3.85GHz, 32C/64T, 256M Cache (320W) DDR5-4800  | 338-CGXD    |  | \$0.00          | 2   |   |                   |
| Additional Processor Selected   | 379-BDCO    |  | \$0.00          | 1   |   |                   |
| Heatsink for 2 CPU configuration  | 412-ABEE    |  | \$0.00          | 1   |   |                   |
| Performance Optimized   | 370-AHLL    |  | \$0.00          | 1   |   |                   |
| 4800MT/s RDIMMs   | 370-AHCL    |  | \$0.00          | 1   |   |                   |
| 32GB RDIMM, 4800MT/s Dual Rank  | 370-AGZP    |  | \$0.00          | 24  |   |                   |
| Unconfigured RAID   | 780-BCDS    |  | \$0.00          | 1   |   |                   |
| PERC H755 SAS Front   | 405-AAZB    |  | \$0.00          | 1   |   |                   |
| Bracket for floating load on fPerc  | 750-ADSN    |  | \$0.00          | 1   |   |                   |
| Performance BIOS Settings   | 384-BBBL    |  | \$0.00          | 1   |   |                   |
| UEFI BIOS Boot Mode with GPT Partition  | 800-BBDM    |  | \$0.00          | 1   |   |                   |
| High Performance Fan x4   | 384-BDHO    |  | \$0.00          | 1   |   |                   |
| Dual, Hot Plug, Power Supply, Redundant (1+1) 1400W (100-240Vac)  | 450-AKWT    |  | \$0.00          | 1   |   |                   |
| C13 to C14, PDU Style, 12 AMP, 6.5 Feet (2m) Power Cord, North America  | 492-BBDI    |  | \$0.00          | 2   |   |                   |
| Riser Config 1, 1 x16 LP + 2 x16 LP   | 330-BCCX    |  | \$0.00          | 1   |   |                   |
| PowerEdge R6625 Motherboard   | 329-BHQD    |  | \$0.00          | 1   |   |                   |
| No OCP 3.0 mezzanine NIC card   | 412-AASK    |  | \$0.00          | 1   |   |                   |
| Broadcom 5720 Dual Port 1GbE Optional LOM   | 540-BDKD    |  | \$0.00          | 1   |   |                   |
| TRAY,W/LBLS,X8/X10,R6625  | 321-BIGJ    |  | \$0.00          | 1   |   |                   |
| No Bezel  | 350-BBBW    |  | \$0.00          | 1   |   |                   |
| BOSS-N1 controller card + with 2 M.2 480GB (RAID 1)   | 403-BCRU    |  | \$0.00          | 1   |   |                   |
| BOSS Cables and Bracket for R660  | 470-AFMG    |  | \$0.00          | 1   |   |                   |
| RHEL, 1-2SKT, Physical Node, 3YR Premium Sub, 1 Virtual Guest, Digitally Fulfilled  | 528-CHFH    |  | \$0.00          | 1   |   |                   |
| No Media Required   | 605-BBFN    |  | \$0.00          | 1   |   |                   |
| iDRAC9, Enterprise 16G  | 528-CTIC    |  | \$0.00          | 1   |   |                   |
| Secured Component Verification  | 528-COYT    |  | \$0.00          | 1   |   |                   |
| No Quick Sync   | 350-BBXM    |  | \$0.00          | 1   |   |                   |
| iDRAC,Factory Generated Password  | 379-BCSF    |  | \$0.00          | 1   |   |                   |
| iDRAC Group Manager, Disabled   | 379-BCQY    |  | \$0.00          | 1   |   |                   |
| No Rack Rails or Cable Management Arm or Strain Relief Bar  | 770-BDMV    |  | \$0.00          | 1   |   |                   |
| No Systems Documentation, No OpenManage DVD Kit   | 631-AAAC    |  | \$0.00          | 1   |   |                   |
| PowerEdge R6625 Shipping  | 340-DDEC    |  | \$0.00          | 1   |   |                   |
| PowerEdge R6625 Shipping Material 4   | 340-DDCC    |  | \$0.00          | 1   |   |                   |
| PowerEdge R6625 CCC Marking, No CE Marking  | 470-AFOR    |  | \$0.00          | 1   |   |                   |
| Basic Next Business Day 36 Months   | 709-BBFM    |  | \$249.00        | 1   | \$249.00  | \$249.00          |
| ProSupport with 4-Hour Onsite Service Initial, 36 Month(s)  | 199-BONO    |  | \$10,312.95     | 1   | \$10,312.95   | \$10,312.95       |
| Dell Wireless Keyboard and Mouse - KM3322W  | 580-AKCW    |  | \$29.99         | 1   | \$29.99   |                   |
| Dell 24 Monitor - S2421HN   | 210-AXHJ    |  | \$158.49        | 1   | \$158.49  |                   |
|   |             |  | <b>Subtotal</b> |     | \$85,988.30   | \$10,561.95       |
| <b>Software</b>   |             |  |                 |     |   |                   |
| Anaconda Pro Subscription - 1 year with Premium Support   |             |  | 2 \$10,000.00   | 1   | \$10,000.00   |                   |
| RHEL, 1-2SKT, Physical Node, 1YR Premium Sub, 1 Virtual Guest, Digitally Fulfilled  | 528-CHFJ    |  | \$1,299.00      | 1   | \$1,299.00  |                   |
|   |             |  | <b>Subtotal</b> |     | \$11,299.00   | \$0.00            |
|   |             |  | <b>Total</b>    |     | \$97,287.30   | \$10,561.95       |
|   |             |  |                 |     | -\$56,736.75  | -\$6,865.27       |
| Pricing: 1 = Dell; 2 = Anaconda<br>* Discount applies to all line items where Key = 1. Discount based upon total system cost as purchased by a regular customer.<br><b>Audited by Doug Johnson, InfoSizing</b>  |             | <b>Total System Cost (USD): \$44,248</b><br><b>AIUCpm@30: 915.67</b><br><b>\$/AIUCpm@30: \$48.33</b> |                 |     |   |                   |
| Prices used in TPC benchmarks reflect the actual prices a customer would pay for a one-time purchase of the stated Line Items. Individually negotiated discounts are not permitted. Special prices based on assumptions about past or future purchases are not permitted. All discounts reflect standard pricing policies for the listed Line Items. For complete details, see the pricing section of the TPC Benchmark Standard. If you find that the stated prices are not available according to these terms, please inform the TPC at <a href="mailto:pricing@tpc.org">pricing@tpc.org</a> . Thank you. |             |  |                 |     |   |                   |

|   |                          |            |             |               |
|---|--------------------------|------------|-------------|---------------|
|  | <h1>PowerEdge R6625</h1> |            | TPCx-AI     | 1.0.3.1       |
|   |                          |            | TPC Pricing | 2.8.0         |
|   |                          |            | Report Date | Sep. 25, 2023 |
| <u>Numerical Quantities</u>   |                          |            |             |               |
| <b>AIUCpm@30</b>  | <b>915.67</b>            | $T_{Load}$ | 6.00        |               |
| Scale Factor  | 30                       | $T_{LD}$   | 6.00        |               |
| Streams   | 100                      | $T_{PTT}$  | 405.10      |               |
| Kit Version   | 1.0.3.1                  | $T_{PST1}$ | 25.97       |               |
| Execution Status  | Pass                     | $T_{PST2}$ | 25.49       |               |
| Accuracy Status   | Pass                     | $T_{PST}$  | 25.97       |               |
|   |                          | $T_{TT}$   | 2.37        |               |
| Test Times  |                          |            |             |               |
| Overall Run Start Time  | 2023-09-19 18:01:31.811  |            |             |               |
| Overall Run End Time  | 2023-09-19 22:54:10.393  |            |             |               |
| Overall Run Elapsed Time  | 17,558.582               |            |             |               |
| Load Test Start Time  | 2023-09-19 18:04:57.960  |            |             |               |
| Load Test End Time  | 2023-09-19 18:05:03.978  |            |             |               |
| Load Test Elapsed Time  | 6.018                    |            |             |               |
| Power Training Start Time   | 2023-09-19 18:05:03.982  |            |             |               |
| Power Training End Time   | 2023-09-19 21:36:36.730  |            |             |               |
| Power Training Elapsed Time   | 12,692.748               |            |             |               |
| Power Serving 1 Start Time  | 2023-09-19 21:36:36.731  |            |             |               |
| Power Serving 1 End Time  | 2023-09-19 21:54:22.046  |            |             |               |
| Power Serving 1 Elapsed Time  | 1,065.315                |            |             |               |
| Power Serving 2 Start Time  | 2023-09-19 21:54:22.047  |            |             |               |
| Power Serving 2 End Time  | 2023-09-19 22:11:55.026  |            |             |               |
| Power Serving 2 Elapsed Time  | 1,052.979                |            |             |               |
| Scoring Start Time  | 2023-09-19 22:12:44.463  |            |             |               |
| Scoring End Time  | 2023-09-19 22:14:39.006  |            |             |               |
| Scoring Elapsed Time  | 114.543                  |            |             |               |
| Throughput Start Time   | 2023-09-19 22:14:39.023  |            |             |               |
| Throughput End Time   | 2023-09-19 22:54:10.388  |            |             |               |
| Throughput Elapsed Time   | 2,371.365                |            |             |               |



# PowerEdge R6625

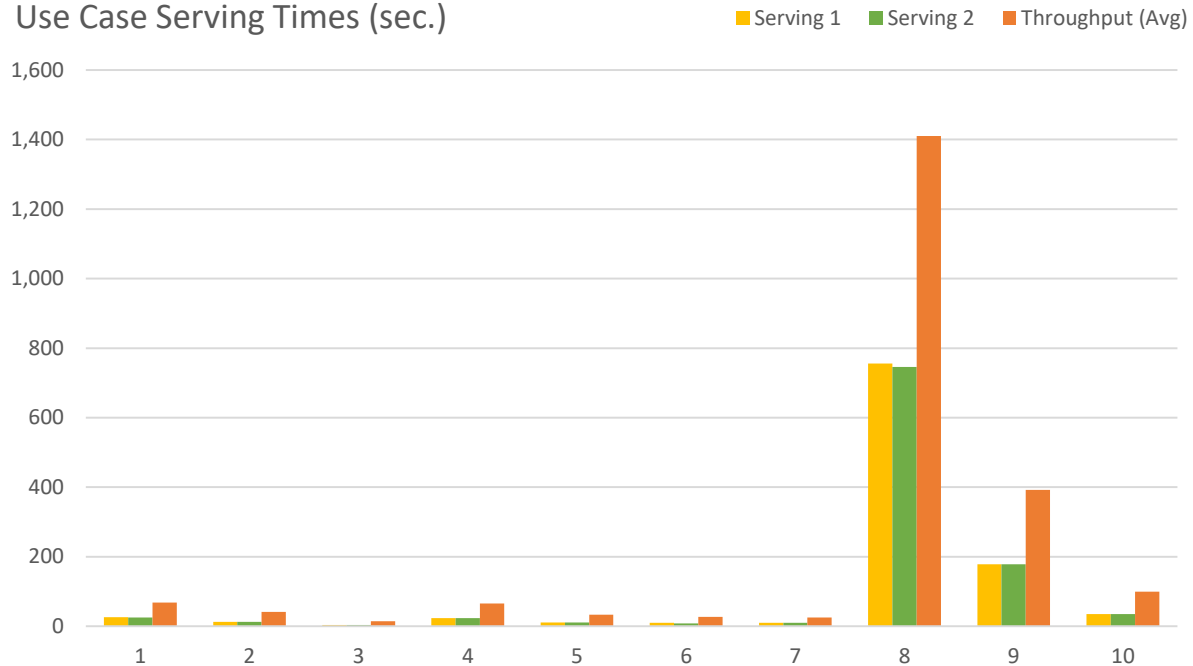
TPCx-AI 1.0.3.1  
 TPC Pricing 2.8.0  
 Report Date Sep. 25, 2023

Numerical Quantities (continued)

Use Case Times & Accuracy

| Use Case | Training (sec) | Serving 1 (sec) | Serving 2 (sec) | Throughput (avg) | Accuracy |
|----------|----------------|-----------------|-----------------|------------------|----------|
| UC01     | 292.511        | 25.919          | 25.567          | 68.027           | 0.000    |
| UC02     | 709.451        | 12.429          | 12.517          | 41.502           | 0.348    |
| UC03     | 304.370        | 3.856           | 3.846           | 14.200           | 3.553    |
| UC04     | 198.782        | 22.923          | 23.070          | 65.745           | 0.706    |
| UC05     | 420.452        | 10.605          | 10.624          | 33.542           | 0.034    |
| UC06     | 195.827        | 9.750           | 8.257           | 26.908           | 0.486    |
| UC07     | 29.298         | 10.001          | 9.901           | 25.041           | 1.007    |
| UC08     | 8,809.189      | 756.114         | 745.901         | 1,410.452        | 0.754    |
| UC09     | 1,418.235      | 178.458         | 177.832         | 391.793          | 1.000    |
| UC10     | 314.530        | 35.170          | 35.362          | 99.433           | 0.817    |

Use Case Serving Times (sec.)



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# Clause 0 – Preamble

## 0.1 TPC Express Benchmark™ AI Overview

Artificial intelligence (AI) has become a key transformational technology of our times. Advances in neural networks and other machine learning techniques have made it possible to use AI on a variety of use cases. From the public sector to aerospace, defense and academia, new and improved ways to use AI techniques are changing the way we harness data and analytics. This along with advances in compute, interconnect and memory technologies have made possible to solve complicated challenges that will ultimately benefit customers in production datacenter and cloud environments.

Abundant volumes of rich data from text, images, audio and video are the essential starting point for creating a benchmark that would represent the myriad of use cases and customers. TPC Express Benchmark™ AI (TPCx-AI) is created in keeping with the TPC tradition of emulating real world AI scenarios and data science use cases. Unlike most other AI benchmarks, the TPCx-AI uses a diverse dataset and is able to scale across a wide range of scale factors. TPCx-AI may later expand with additional use cases and add additional flexibility for a greater variety of implementations.

The benchmark defines and provides a means to evaluate the System Under Test (SUT) performance as a general-purpose data science system that:

- Generates and processes large volumes of data.
- Trains preprocessed data to produce realistic machine learning models.
- Conducts accurate insights for real-world customer scenarios based on the generated models.
- Can scale to large scale distributed configurations.
- Allows for flexibility in configuration changes to meet the demands of the dynamic AI landscape.

The benchmark models real-life examples of companies and public-sector organizations that use a range of analytics techniques, both AI and more traditional machine learning approaches, as well as the potential application of these techniques in situations like those in which they have already been successfully deployed. In addition, the benchmark measures end to end time to provide insights for individual use cases, as well as throughput metrics to simulate multiuser environments for a given hardware, operating system, and data processing system configuration under a controlled, complex, multi-user AI or machine learning data science workload.

The purpose of TPC benchmarks is to provide relevant, objective performance data to industry users. To achieve that purpose, TPC benchmark specifications require benchmark runs be implemented with systems, products, technologies and pricing that:

- Are generally available to users.
- Are relevant to the market segment that the individual TPC benchmark models or represents (e.g., TPCx-AI models and represents complex, high data volume, decision support environments).
- Would plausibly be implemented.

The TPCx-AI kit is available from the TPC website (see [www.tpc.org/tpcx-ai/](http://www.tpc.org/tpcx-ai/) for more information). Users must sign up and agree to the TPCx-AI End User Licensing Agreement (EULA) to download the kit. All related work (such as collaterals, papers, derivatives) must acknowledge the TPC and include the TPCx-AI copyright. The TPCx-AI kit includes: TPCx-AI Specification document (this document), TPCx-AI Users Guide (README.md) documentation, scripts to set up the benchmark environment, code to execute the benchmark workload, Data Generator, use case related files, and Benchmark Driver.

The use of new systems, products, technologies (hardware or software) and pricing is encouraged so long as they meet the requirements above. Specifically prohibited are benchmark systems, products, technologies or pricing (hereafter referred to as "implementations") whose primary purpose is performance optimization of TPC benchmark results without any corresponding applicability to real-world applications and environments. In other words, all "benchmark special" implementations that improve benchmark results but not real-world performance or pricing, are prohibited.

The rules for pricing are included in the TPC Pricing Specification.

Further information is available at [www.tpc.org](http://www.tpc.org).

# Clause 1 – General Items

## 1.1 Test Sponsor

This benchmark was sponsored by Dell Inc..

## 1.2 Parameter Settings

The [Supporting Files Archive](#) contains the parameters and options used to configure the components involved in this benchmark.

## 1.3 Configuration Diagrams

The measured configuration diagram is shown below. In addition, any differences between the measured and the priced configurations are described.

### 1.3.1 Measured Configuration

|                           |          |                          |
|---------------------------|----------|--------------------------|
| Nodes:                    | 1        |                          |
| Processors/Cores/Threads: | 2/64/128 | Storage Devices: 2       |
| Total Memory:             | 768 GiB  | Storage Capacity: 960 GB |

The diagram illustrates the hardware configuration of a single server node. It features two CPUs, CPU 0 and CPU 1, which are interconnected via xGMI. CPU 0 is connected to DIMM 0 through DIMM 11, while CPU 1 is connected to DIMM 12 through DIMM 23. Both CPUs share a common storage configuration consisting of two 480GB M.2 NVME SSDs in a RAID1 configuration, managed by a Dell BOSS N1 (OS+Kit). Additionally, a Network Interface Card (NIC) is connected to the system.

| <u>Server</u>        |   |
|----------------------|---|
| Server               | 1x PowerEdge R6625:                           |
| Procs/Cores/Threads: | 2/32/64                                       |
| Processor Model:     | 2x AMD EPYC 9374F 32-Core Processor           |
| Memory:              | 768 GiB                                       |
| Storage Controller:  | 1x Dell BOSS-N1                               |
| Storage Devices:     | 2x 480 GB M.2 NVMe SSD                        |
| Network Controller:  | 1x Broadcom NetXtreme BCM5720 Dual Port 1 GbE |

The distribution of software components over server nodes is detailed in [Clause 2](#).

### 1.3.2 Differences Between the Measured and the Priced Configurations

There are no differences between the measured configuration and the priced configuration.

## Clause 2 – SW Components & Data Distribution

### 2.1 Roles and Dataset Distribution

Table 2-1 describes the distribution of the dataset across all media in the SUT.

| Server             | Host Name        | SW Services | Storage                | Contents |
|--------------------|------------------|-------------|------------------------|----------|
| 1x PowerEdge R6625 | idrac-brdpt02-os | All         | 2x 480 GB M.2 NVMe SSD | OS, Data |

Table 2-1 Software Components and Dataset Distribution

### 2.2 File System Implementation

A local file system provided by Red Hat Enterprise Linux 8.6 (Ootpa) / Anaconda Pro was used for data generation and the Load Test. The data set was not relocated after generation and before the Load Test.

### 2.3 Execution Engine, Frameworks, Driver & Libraries

Anaconda Pro consisted of the following components.

| Component    | Version |
|--------------|---------|
| conda        | 23.7.2  |
| python       | 3.9.18  |
| setuptools   | 59.8.0  |
| pandas       | 1.5.3   |
| scikit-learn | 1.2.2   |
| xgboost      | 1.7.4   |
| numpy        | 1.23.5  |
| nose         | 1.3.7   |
| scipy        | 1.10.1  |
| statsmodels  | 0.13.5  |
| patsy        | 0.5.3   |
| tqdm         | 4.65.2  |
| keras        | 2.11.0  |
| tensorflow   | 2.11.0  |
| joblib       | 1.2.0   |
| opencv       | 4.5.3   |
| pyyaml       | 6.0.1   |
| matplotlib   | 3.7.1   |
| jinja2       | 3.1.2   |

Table 2-2 Software Components

For a detailed listing of installed libraries, please see the envInfo logs in the [Supporting Files](#).

### 2.4 Applied Patches

No additional vendor-supported patches were applied to the SUT.

## Clause 3 – Workload Related Items

### 3.1 Hardware & Software Tuning

The [Supporting Files](#) archive contains all hardware and software configuration scripts.

### 3.2 Kit Version & Modifications

Table 3-1 shows the version of the TPCx-AI used to produce this result along with any kit files that were modified to facilitate system, platform, and framework differences.

|   |   |
|---|---|
| TPCx-AI Kit Version   | 1.0.3.1   |
| <u>Modified File</u><br>tools/python/dataRedundancyInformation.sh | <u>Description of Changes</u><br>Added platform-specific data collection. |

Table 3-1 Kit Version & Modifications

### 3.3 Use Case Elapsed Times

Below are the elapsed times for each use case. Use cases are grouped based on whether they use Deep Learning or Machine Learning techniques.

| Type             | UC ID | P1      | P2      | T1        | T2        | T3        | T4        |
|------------------|-------|---------|---------|-----------|-----------|-----------|-----------|
| Deep Learning    | 2     | 12.429  | 12.517  | 39.039    | 25.616    | 29.472    | 39.208    |
|                  | 5     | 10.605  | 10.624  | 54.216    | 38.550    | 23.348    | 27.546    |
|                  | 9     | 178.458 | 177.832 | 343.779   | 349.486   | 456.661   | 371.575   |
| Machine Learning | 1     | 25.919  | 25.567  | 58.612    | 123.337   | 81.212    | 85.358    |
|                  | 3     | 3.856   | 3.846   | 24.226    | 8.869     | 4.352     | 19.110    |
|                  | 4     | 22.923  | 23.070  | 42.644    | 80.013    | 48.426    | 116.938   |
|                  | 6     | 9.750   | 8.257   | 22.086    | 29.628    | 28.432    | 20.632    |
|                  | 7     | 10.001  | 9.901   | 20.101    | 25.204    | 25.505    | 13.017    |
|                  | 8     | 756.114 | 745.901 | 1,467.935 | 1,199.578 | 1,535.990 | 1,538.297 |
|                  | 10    | 35.170  | 35.362  | 144.300   | 86.613    | 95.545    | 114.535   |

| Type             | UC ID | T5        | T6        | T7        | T8        | T9        | T10       |
|------------------|-------|-----------|-----------|-----------|-----------|-----------|-----------|
| Deep Learning    | 2     | 35.966    | 42.555    | 24.633    | 25.797    | 36.690    | 33.837    |
|                  | 5     | 22.591    | 72.158    | 15.698    | 24.400    | 43.403    | 46.832    |
|                  | 9     | 465.166   | 381.640   | 379.823   | 431.969   | 395.006   | 397.628   |
| Machine Learning | 1     | 73.168    | 63.399    | 119.213   | 44.199    | 77.762    | 71.870    |
|                  | 3     | 10.553    | 7.149     | 11.555    | 51.986    | 49.720    | 8.939     |
|                  | 4     | 45.385    | 40.820    | 57.361    | 40.508    | 49.945    | 64.709    |
|                  | 6     | 27.417    | 16.903    | 24.926    | 13.869    | 26.373    | 65.300    |
|                  | 7     | 21.992    | 16.690    | 44.244    | 12.822    | 25.316    | 10.361    |
|                  | 8     | 1,120.217 | 1,571.236 | 1,167.821 | 1,470.503 | 1,522.875 | 1,562.362 |
|                  | 10    | 89.223    | 80.885    | 54.846    | 87.871    | 82.547    | 68.312    |

| Type             | UC ID | T11       | T12       | T13       | T14       | T15       | T16       |
|------------------|-------|-----------|-----------|-----------|-----------|-----------|-----------|
| Deep Learning    | 2     | 30.508    | 50.169    | 33.873    | 25.449    | 34.202    | 32.053    |
|                  | 5     | 49.652    | 20.548    | 28.958    | 53.828    | 21.288    | 41.195    |
|                  | 9     | 349.431   | 371.897   | 457.554   | 407.819   | 374.595   | 400.630   |
| Machine Learning | 1     | 118.391   | 65.294    | 49.524    | 50.224    | 53.406    | 60.846    |
|                  | 3     | 9.322     | 14.212    | 15.420    | 7.896     | 10.481    | 7.548     |
|                  | 4     | 68.664    | 117.483   | 56.541    | 61.626    | 42.432    | 54.212    |
|                  | 6     | 28.846    | 33.454    | 15.507    | 20.606    | 21.758    | 16.235    |
|                  | 7     | 25.188    | 15.084    | 23.037    | 19.408    | 26.277    | 32.877    |
|                  | 8     | 1,339.513 | 1,495.049 | 1,449.678 | 1,517.079 | 1,452.905 | 1,446.095 |
|                  | 10    | 92.311    | 91.878    | 92.559    | 170.116   | 167.068   | 171.131   |

| Type             | UC ID | T17       | T18       | T19       | T20       | T21       | T22       |
|------------------|-------|-----------|-----------|-----------|-----------|-----------|-----------|
| Deep Learning    | 2     | 31.946    | 38.319    | 29.924    | 32.121    | 40.712    | 28.976    |
|                  | 5     | 21.680    | 40.237    | 52.709    | 30.069    | 21.134    | 32.488    |
|                  | 9     | 367.936   | 378.855   | 375.276   | 463.926   | 460.080   | 488.041   |
| Machine Learning | 1     | 118.615   | 70.602    | 76.239    | 47.588    | 76.075    | 64.987    |
|                  | 3     | 13.207    | 11.901    | 27.200    | 7.790     | 20.561    | 11.136    |
|                  | 4     | 55.622    | 118.958   | 55.807    | 51.041    | 85.187    | 54.136    |
|                  | 6     | 19.084    | 15.323    | 33.087    | 20.519    | 25.192    | 23.033    |
|                  | 7     | 16.884    | 12.496    | 37.775    | 22.371    | 20.221    | 22.481    |
|                  | 8     | 1,470.390 | 1,517.759 | 1,515.584 | 1,537.606 | 1,143.411 | 1,390.255 |
|                  | 10    | 65.925    | 126.443   | 73.780    | 78.824    | 78.834    | 74.222    |



| Type             | UC ID | T23       | T24       | T25       | T26       | T27       | T28       |
|------------------|-------|-----------|-----------|-----------|-----------|-----------|-----------|
| Deep Learning    | 2     | 33.911    | 44.535    | 36.774    | 26.099    | 37.367    | 42.526    |
|                  | 5     | 62.981    | 17.943    | 70.209    | 76.296    | 33.229    | 32.834    |
|                  | 9     | 433.121   | 428.180   | 389.637   | 400.117   | 390.826   | 330.025   |
| Machine Learning | 1     | 43.297    | 58.186    | 67.324    | 41.479    | 119.231   | 61.952    |
|                  | 3     | 6.732     | 10.314    | 7.064     | 9.897     | 10.437    | 57.666    |
|                  | 4     | 79.976    | 63.994    | 52.585    | 41.492    | 66.481    | 54.941    |
|                  | 6     | 30.299    | 66.519    | 16.284    | 23.521    | 34.005    | 19.723    |
|                  | 7     | 25.478    | 17.535    | 18.461    | 25.795    | 17.859    | 20.551    |
|                  | 8     | 1,323.435 | 1,459.143 | 1,530.230 | 1,492.904 | 1,536.322 | 1,577.401 |
|                  | 10    | 62.651    | 84.000    | 128.212   | 96.379    | 67.761    | 79.920    |

| Type             | UC ID | T29       | T30       | T31       | T32       | T33       | T34       |
|------------------|-------|-----------|-----------|-----------|-----------|-----------|-----------|
| Deep Learning    | 2     | 32.833    | 56.107    | 36.616    | 36.010    | 32.892    | 89.575    |
|                  | 5     | 32.363    | 29.382    | 15.855    | 44.413    | 39.768    | 19.252    |
|                  | 9     | 399.585   | 444.389   | 453.860   | 382.476   | 434.518   | 407.126   |
| Machine Learning | 1     | 28.661    | 75.295    | 49.028    | 73.065    | 85.509    | 64.403    |
|                  | 3     | 3.834     | 10.839    | 9.713     | 12.206    | 6.769     | 8.038     |
|                  | 4     | 118.052   | 52.146    | 41.707    | 119.819   | 116.984   | 61.047    |
|                  | 6     | 9.409     | 22.300    | 23.374    | 22.368    | 16.342    | 22.471    |
|                  | 7     | 35.123    | 68.283    | 21.475    | 26.691    | 15.533    | 18.678    |
|                  | 8     | 1,587.067 | 1,118.210 | 1,528.517 | 1,384.924 | 1,107.047 | 1,194.863 |
|                  | 10    | 117.218   | 77.709    | 90.401    | 74.267    | 83.980    | 102.606   |

| Type             | UC ID | T35       | T36       | T37       | T38       | T39       | T40       |
|------------------|-------|-----------|-----------|-----------|-----------|-----------|-----------|
| Deep Learning    | 2     | 78.545    | 36.077    | 35.430    | 53.362    | 41.675    | 36.389    |
|                  | 5     | 19.557    | 22.281    | 69.048    | 48.893    | 73.308    | 44.585    |
|                  | 9     | 380.397   | 353.846   | 373.614   | 414.305   | 407.584   | 322.619   |
| Machine Learning | 1     | 46.422    | 67.338    | 64.588    | 70.321    | 67.005    | 119.840   |
|                  | 3     | 8.270     | 6.729     | 9.887     | 11.553    | 7.664     | 14.729    |
|                  | 4     | 78.878    | 57.773    | 89.687    | 118.927   | 54.247    | 53.169    |
|                  | 6     | 30.600    | 25.027    | 33.251    | 9.618     | 17.902    | 22.917    |
|                  | 7     | 19.060    | 30.094    | 20.824    | 20.469    | 21.256    | 18.293    |
|                  | 8     | 1,463.607 | 1,190.945 | 1,123.415 | 1,465.929 | 1,126.647 | 1,555.474 |
|                  | 10    | 107.745   | 169.016   | 131.096   | 89.070    | 103.569   | 113.893   |

| Type             | UC ID | T41       | T42       | T43       | T44       | T45       | T46       |
|------------------|-------|-----------|-----------|-----------|-----------|-----------|-----------|
| Deep Learning    | 2     | 43.042    | 43.644    | 43.792    | 28.966    | 35.178    | 35.711    |
|                  | 5     | 46.858    | 63.508    | 11.361    | 56.728    | 48.757    | 25.441    |
|                  | 9     | 365.074   | 326.259   | 372.798   | 350.756   | 387.196   | 335.312   |
| Machine Learning | 1     | 80.816    | 63.864    | 29.131    | 62.287    | 58.746    | 129.938   |
|                  | 3     | 7.669     | 7.640     | 10.498    | 17.399    | 8.657     | 13.908    |
|                  | 4     | 55.430    | 62.420    | 117.428   | 64.234    | 52.014    | 50.771    |
|                  | 6     | 25.271    | 25.734    | 24.752    | 19.100    | 26.611    | 21.742    |
|                  | 7     | 14.591    | 18.117    | 37.944    | 19.290    | 69.336    | 16.314    |
|                  | 8     | 1,080.426 | 1,557.520 | 1,605.941 | 1,419.916 | 1,526.411 | 1,579.005 |
|                  | 10    | 175.172   | 132.553   | 90.756    | 124.570   | 89.912    | 98.037    |

| Type             | UC ID | T47       | T48       | T49       | T50       | T51       | T52       |
|------------------|-------|-----------|-----------|-----------|-----------|-----------|-----------|
| Deep Learning    | 2     | 32.996    | 36.080    | 49.117    | 31.055    | 37.018    | 39.843    |
|                  | 5     | 14.577    | 48.179    | 33.259    | 34.514    | 12.899    | 21.421    |
|                  | 9     | 329.141   | 389.112   | 419.332   | 425.530   | 402.421   | 404.066   |
| Machine Learning | 1     | 117.694   | 84.384    | 56.909    | 67.422    | 65.314    | 54.615    |
|                  | 3     | 8.101     | 6.559     | 8.887     | 7.524     | 9.772     | 6.974     |
|                  | 4     | 87.486    | 55.006    | 53.399    | 60.539    | 46.719    | 56.769    |
|                  | 6     | 22.080    | 24.429    | 16.165    | 20.820    | 32.184    | 63.664    |
|                  | 7     | 20.534    | 71.444    | 17.084    | 19.154    | 68.336    | 21.514    |
|                  | 8     | 1,444.358 | 1,506.321 | 1,471.333 | 1,531.482 | 1,537.944 | 1,501.263 |
|                  | 10    | 99.285    | 77.738    | 169.872   | 97.261    | 87.532    | 75.866    |

| Type             | UC ID | T53       | T54       | T55       | T56       | T57       | T58       |
|------------------|-------|-----------|-----------|-----------|-----------|-----------|-----------|
| Deep Learning    | 2     | 97.665    | 59.928    | 12.931    | 26.285    | 40.290    | 87.505    |
|                  | 5     | 51.852    | 26.070    | 28.511    | 15.308    | 26.905    | 26.906    |
|                  | 9     | 388.210   | 351.471   | 432.917   | 359.959   | 319.254   | 356.016   |
| Machine Learning | 1     | 52.175    | 53.683    | 69.819    | 69.353    | 89.841    | 93.473    |
|                  | 3     | 11.094    | 26.904    | 9.521     | 8.366     | 9.239     | 19.262    |
|                  | 4     | 77.829    | 57.295    | 47.965    | 38.096    | 120.397   | 65.056    |
|                  | 6     | 27.193    | 59.833    | 40.379    | 23.058    | 23.786    | 16.444    |
|                  | 7     | 23.109    | 19.559    | 22.179    | 14.701    | 29.043    | 25.842    |
|                  | 8     | 1,154.044 | 1,566.785 | 1,643.368 | 1,266.893 | 1,483.898 | 1,126.998 |
|                  | 10    | 75.196    | 94.849    | 43.127    | 130.104   | 120.474   | 87.298    |

| Type             | UC ID | T59       | T60       | T61       | T62       | T63       | T64       |
|------------------|-------|-----------|-----------|-----------|-----------|-----------|-----------|
| Deep Learning    | 2     | 31.848    | 26.630    | 36.296    | 44.932    | 35.113    | 36.278    |
|                  | 5     | 25.483    | 26.232    | 24.526    | 25.935    | 35.721    | 42.295    |
|                  | 9     | 332.734   | 361.889   | 393.037   | 272.822   | 435.707   | 324.595   |
| Machine Learning | 1     | 59.395    | 45.820    | 85.828    | 45.631    | 59.584    | 59.586    |
|                  | 3     | 7.652     | 7.306     | 12.100    | 16.284    | 21.350    | 9.895     |
|                  | 4     | 72.580    | 66.570    | 121.261   | 57.740    | 82.169    | 51.721    |
|                  | 6     | 21.657    | 23.635    | 34.162    | 23.203    | 29.583    | 24.519    |
|                  | 7     | 22.828    | 22.957    | 31.542    | 25.466    | 27.606    | 18.915    |
|                  | 8     | 1,518.556 | 1,465.045 | 1,113.822 | 1,258.601 | 1,092.463 | 1,628.890 |
|                  | 10    | 168.214   | 190.345   | 116.643   | 73.027    | 77.062    | 85.760    |

| Type             | UC ID | T65       | T66       | T67       | T68       | T69       | T70       |
|------------------|-------|-----------|-----------|-----------|-----------|-----------|-----------|
| Deep Learning    | 2     | 53.585    | 54.359    | 40.442    | 52.674    | 38.212    | 32.996    |
|                  | 5     | 31.190    | 37.519    | 17.354    | 72.252    | 20.478    | 29.638    |
|                  | 9     | 401.316   | 332.775   | 447.210   | 371.008   | 402.695   | 420.272   |
| Machine Learning | 1     | 51.094    | 119.814   | 29.918    | 57.938    | 47.958    | 60.122    |
|                  | 3     | 7.247     | 18.027    | 15.920    | 7.722     | 7.968     | 54.454    |
|                  | 4     | 47.004    | 52.810    | 46.673    | 77.207    | 61.624    | 45.122    |
|                  | 6     | 28.028    | 26.162    | 19.745    | 14.227    | 60.759    | 29.689    |
|                  | 7     | 66.904    | 15.729    | 70.821    | 25.963    | 15.025    | 31.111    |
|                  | 8     | 1,492.129 | 1,481.034 | 1,557.313 | 1,477.546 | 1,580.340 | 1,160.665 |
|                  | 10    | 110.381   | 94.589    | 78.440    | 93.328    | 82.688    | 129.964   |

| Type             | UC ID | T71       | T72       | T73       | T74       | T75       | T76       |
|------------------|-------|-----------|-----------|-----------|-----------|-----------|-----------|
| Deep Learning    | 2     | 26.842    | 12.733    | 52.598    | 84.861    | 30.079    | 24.938    |
|                  | 5     | 16.858    | 34.049    | 30.712    | 38.119    | 16.219    | 35.493    |
|                  | 9     | 358.233   | 351.851   | 331.275   | 363.161   | 397.886   | 385.123   |
| Machine Learning | 1     | 66.327    | 124.143   | 87.984    | 56.818    | 43.595    | 51.319    |
|                  | 3     | 4.755     | 9.769     | 12.167    | 34.374    | 56.631    | 6.068     |
|                  | 4     | 57.682    | 91.895    | 57.967    | 68.088    | 44.757    | 123.319   |
|                  | 6     | 65.960    | 25.874    | 62.280    | 20.433    | 23.228    | 23.629    |
|                  | 7     | 21.770    | 19.243    | 19.382    | 21.106    | 18.342    | 16.504    |
|                  | 8     | 1,579.708 | 1,579.427 | 1,482.884 | 1,536.065 | 1,211.782 | 1,303.517 |
|                  | 10    | 132.865   | 86.566    | 64.663    | 98.607    | 64.056    | 68.075    |

| Type             | UC ID | T77       | T78       | T79       | T80       | T81       | T82       |
|------------------|-------|-----------|-----------|-----------|-----------|-----------|-----------|
| Deep Learning    | 2     | 50.381    | 39.842    | 39.864    | 35.167    | 38.057    | 66.847    |
|                  | 5     | 15.127    | 15.295    | 29.656    | 25.112    | 39.283    | 8.791     |
|                  | 9     | 383.711   | 468.659   | 455.761   | 369.105   | 441.532   | 390.253   |
| Machine Learning | 1     | 58.667    | 60.833    | 53.700    | 46.185    | 69.291    | 39.989    |
|                  | 3     | 55.676    | 9.755     | 7.911     | 13.203    | 5.920     | 6.847     |
|                  | 4     | 103.983   | 39.837    | 49.981    | 57.600    | 59.978    | 83.932    |
|                  | 6     | 19.847    | 19.614    | 16.541    | 12.968    | 22.103    | 65.726    |
|                  | 7     | 22.498    | 16.908    | 18.207    | 20.453    | 17.158    | 27.519    |
|                  | 8     | 1,417.324 | 1,526.107 | 1,509.806 | 1,558.697 | 1,449.385 | 1,198.417 |
|                  | 10    | 107.775   | 79.642    | 83.389    | 66.084    | 162.791   | 121.116   |

| Type             | UC ID | T83       | T84       | T85       | T86       | T87       | T88       |
|------------------|-------|-----------|-----------|-----------|-----------|-----------|-----------|
| Deep Learning    | 2     | 95.418    | 50.276    | 32.551    | 30.957    | 97.129    | 22.525    |
|                  | 5     | 31.895    | 71.574    | 38.385    | 31.501    | 18.905    | 19.254    |
|                  | 9     | 402.617   | 334.883   | 423.194   | 428.771   | 434.372   | 408.741   |
| Machine Learning | 1     | 58.908    | 52.406    | 27.627    | 85.786    | 55.978    | 39.921    |
|                  | 3     | 6.574     | 11.008    | 13.287    | 28.929    | 11.970    | 6.190     |
|                  | 4     | 45.083    | 94.877    | 76.094    | 56.209    | 53.527    | 43.822    |
|                  | 6     | 16.944    | 19.459    | 65.888    | 22.080    | 22.393    | 17.359    |
|                  | 7     | 18.836    | 25.203    | 10.010    | 48.434    | 14.929    | 17.315    |
|                  | 8     | 1,551.598 | 1,472.457 | 1,564.910 | 1,068.694 | 1,451.449 | 1,252.609 |
|                  | 10    | 84.954    | 100.898   | 91.022    | 84.577    | 88.869    | 60.547    |

| Type             | UC ID | T89       | T90       | T91       | T92       | T93       | T94       |
|------------------|-------|-----------|-----------|-----------|-----------|-----------|-----------|
| Deep Learning    | 2     | 54.102    | 29.834    | 39.121    | 38.551    | 24.153    | 49.711    |
|                  | 5     | 32.733    | 36.617    | 24.892    | 26.927    | 16.973    | 29.565    |
|                  | 9     | 412.159   | 404.274   | 321.277   | 410.143   | 423.105   | 482.272   |
| Machine Learning | 1     | 87.616    | 94.575    | 75.104    | 54.340    | 52.400    | 60.445    |
|                  | 3     | 8.413     | 9.222     | 19.427    | 7.783     | 6.409     | 8.581     |
|                  | 4     | 117.972   | 28.425    | 60.298    | 47.948    | 43.254    | 41.942    |
|                  | 6     | 19.164    | 21.769    | 30.014    | 13.768    | 21.636    | 19.011    |
|                  | 7     | 25.740    | 67.313    | 19.923    | 16.190    | 12.452    | 19.166    |
|                  | 8     | 1,107.927 | 1,533.419 | 1,509.334 | 1,533.453 | 1,332.803 | 1,515.194 |
|                  | 10    | 80.911    | 93.568    | 161.123   | 75.339    | 70.313    | 88.999    |

| Type             | UC ID | T95       | T96       | T97       | T98       | T99       | T100      |
|------------------|-------|-----------|-----------|-----------|-----------|-----------|-----------|
| Deep Learning    | 2     | 41.734    | 21.389    | 74.151    | 85.169    | 41.474    | 27.518    |
|                  | 5     | 25.040    | 14.893    | 29.546    | 23.990    | 35.389    | 24.960    |
|                  | 9     | 378.795   | 456.924   | 349.214   | 390.675   | 330.571   | 464.904   |
| Machine Learning | 1     | 120.929   | 41.235    | 52.117    | 64.201    | 89.373    | 55.830    |
|                  | 3     | 7.765     | 7.885     | 9.559     | 21.296    | 55.251    | 8.049     |
|                  | 4     | 60.586    | 38.484    | 48.925    | 89.595    | 58.282    | 48.456    |
|                  | 6     | 31.372    | 14.813    | 64.294    | 18.631    | 21.652    | 29.636    |
|                  | 7     | 19.994    | 19.714    | 20.294    | 19.439    | 29.368    | 26.968    |
|                  | 8     | 1,146.774 | 1,313.027 | 1,391.638 | 1,378.097 | 1,056.042 | 1,484.080 |
|                  | 10    | 125.257   | 59.292    | 121.168   | 109.461   | 108.292   | 65.746    |

Table 3-2 Use Case Elapsed Times

### 3.4 SUT Validation Test Output

| <u>Validation Run Report</u> |         |                         |           |
|------------------------------|---------|-------------------------|-----------|
| AIUCpm@1                     | 336.42  | T <sub>Load</sub>       | 0.43      |
| Scale Factor                 | 1       | T <sub>LD</sub>         | 0.43      |
| Streams                      | 100     | T <sub>PTT</sub>        | 27.50     |
| Kit Version                  | 1.0.3.1 | T <sub>PST1</sub>       | 3.52      |
| Execution Status             | Pass    | T <sub>PST2</sub>       | 3.56      |
| Accuracy Status              | Pass    | T <sub>PST</sub>        | 3.56      |
|                              |         | T <sub>TT</sub>         | 0.24      |
| Test Times                   |         |                         |           |
| Overall Run Start Time       |         | 2023-09-19 17:24:55.751 |           |
| Overall Run End Time         |         | 2023-09-19 18:01:08.316 |           |
| Overall Run Elapsed Time     |         |                         | 2,172.565 |
| Load Test Start Time         |         | 2023-09-19 17:26:32.828 |           |
| Load Test End Time           |         | 2023-09-19 17:26:33.277 |           |
| Load Test Elapsed Time       |         |                         | 0.449     |
| Power Training Start Time    |         | 2023-09-19 17:26:33.278 |           |
| Power Training End Time      |         | 2023-09-19 17:51:30.929 |           |
| Power Training Elapsed Time  |         |                         | 1,497.651 |
| Power Serving 1 Start Time   |         | 2023-09-19 17:51:30.930 |           |
| Power Serving 1 End Time     |         | 2023-09-19 17:52:57.356 |           |
| Power Serving 1 Elapsed Time |         |                         | 86.426    |
| Power Serving 2 Start Time   |         | 2023-09-19 17:52:57.358 |           |
| Power Serving 2 End Time     |         | 2023-09-19 17:54:23.753 |           |
| Power Serving 2 Elapsed Time |         |                         | 86.395    |
| Scoring Start Time           |         | 2023-09-19 17:55:10.884 |           |
| Scoring End Time             |         | 2023-09-19 17:57:03.290 |           |
| Scoring Elapsed Time         |         |                         | 112.406   |
| Throughput Start Time        |         | 2023-09-19 17:57:03.307 |           |
| Throughput End Time          |         | 2023-09-19 18:01:08.312 |           |
| Throughput Elapsed Time      |         |                         | 245.005   |
| (continued on next page)     |         |                         |           |

Validation Run Report (continued)

| Accuracy Metrics |                        |        |          |           |        |
|------------------|------------------------|--------|----------|-----------|--------|
| Use Case         | Metric Name            | Metric | Criteria | Threshold | Status |
| 1                | N/A                    | 0.000  | N/A      | 0.00      | Pass   |
| 2                | word_error_rate        | 1.609  | <=       | 0.50      | Pass   |
| 3                | mean_squared_log_error | 16.270 | <=       | 5.40      | Pass   |
| 4                | f1_score               | 2.813  | >=       | 0.65      | Pass   |
| 5                | mean_squared_log_error | 0.093  | <=       | 0.50      | Pass   |
| 6                | matthews_corrcoef      | 1.904  | >=       | 0.19      | Pass   |
| 7                | median_absolute_error  | 3.791  | <=       | 1.80      | Pass   |
| 8                | accuracy_score         | 2.940  | >=       | 0.65      | Pass   |
| 9                | accuracy_score         | 4.000  | >=       | 0.90      | Pass   |
| 10               | accuracy_score         | 3.267  | >=       | 0.70      | Pass   |

### 3.5 Configuration Parameters

The [Supporting Files](#) archive contains all Global Benchmark Parameter and Use Case Specific Parameter settings.

## Clause 4 – SUT Related Items

### 4.1 Specialized Hardware/Software

No Specialized Hardware/Software was used in the SUT.

### 4.2 Configuration Files

The [Supporting Files](#) archive contains all configuration files.

### 4.3 SUT Environment Information

All envInfo.log files are included in the [Supporting Files](#) archive.

### 4.4 Data Storage to Scale Factor Ratio

The details of the Data Storage Ratio are provided below.

| Node Count         | Disks | Size (GB) | Total (GB) |
|--------------------|-------|-----------|------------|
| 1                  | 2     | 480       | 960        |
| Total Storage (GB) |       |           | 960        |
| Scale Factor       |       |           | 30         |
| Data Storage Ratio |       |           | 32.00      |

### 4.5 Scale Factor to Memory Ratio

The details of the Memory to Scale Factor Ratio are provided below.

| Node Count         | Memory (GiB) | Total (GiB) |
|--------------------|--------------|-------------|
| 1                  | 768          | 768         |
| Scale Factor       |              | 30          |
| Total Memory (GiB) |              | 768         |
| SF / Memory Ratio  |              | 0.04        |

### 4.6 Output of Tests

The [Supporting Files](#) archive contains the output files of all tests.

### 4.7 Additional Sponsor Files

The [Supporting Files](#) archive contains any additional files that were used.

### 4.8 Model Optimizations

The [Supporting Files](#) archive contains any model optimization files that were used.



# Clause 5 – Metrics and Scale Factor

## 5.1 Reported Performance Metrics

### Metric Overview

|                                  |        |              |
|----------------------------------|--------|--------------|
| TPCx-AI Performance Metric       | 915.67 | AIUCpm@30    |
| TPCx-AI Price/Performance Metric | 48.33  | \$/AIUCpm@30 |
| TPCx-AI Scale Factor             | 30     |              |
| TPCx-AI Stream Count             | 100    |              |

### Test Times

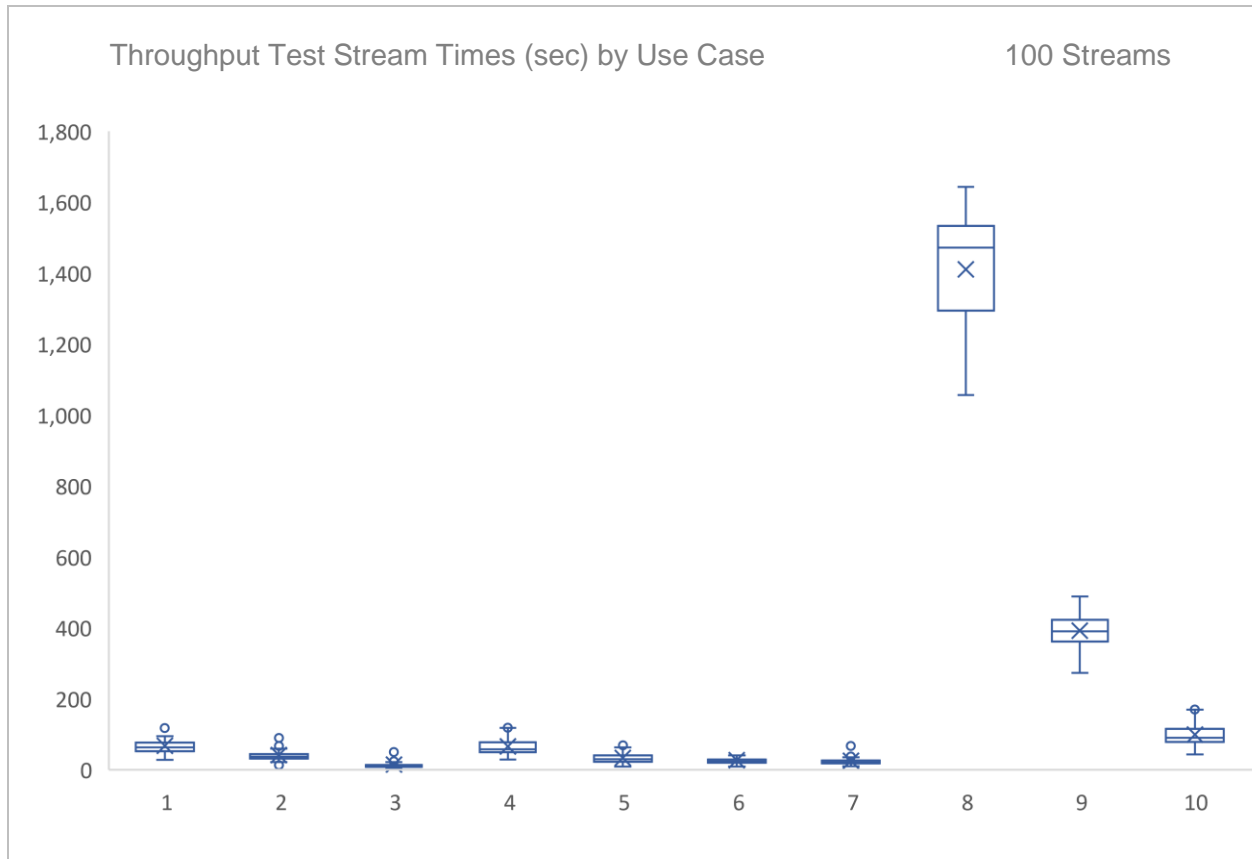
|                              |                         |
|------------------------------|-------------------------|
| Overall Run Start Time       | 2023-09-19 18:01:31.811 |
| Overall Run End Time         | 2023-09-19 22:54:10.393 |
| Overall Run Elapsed Time     | 17,558.582              |
| Load Test Start Time         | 2023-09-19 18:04:57.960 |
| Load Test End Time           | 2023-09-19 18:05:03.978 |
| Load Test Elapsed Time       | 6.018                   |
| Power Training Start Time    | 2023-09-19 18:05:03.982 |
| Power Training End Time      | 2023-09-19 21:36:36.730 |
| Power Training Elapsed Time  | 12,692.748              |
| Power Serving 1 Start Time   | 2023-09-19 21:36:36.731 |
| Power Serving 1 End Time     | 2023-09-19 21:54:22.046 |
| Power Serving 1 Elapsed Time | 1,065.315               |
| Power Serving 2 Start Time   | 2023-09-19 21:54:22.047 |
| Power Serving 2 End Time     | 2023-09-19 22:11:55.026 |
| Power Serving 2 Elapsed Time | 1,052.979               |
| Scoring Start Time           | 2023-09-19 22:12:44.463 |
| Scoring End Time             | 2023-09-19 22:14:39.006 |
| Scoring Elapsed Time         | 114.543                 |
| Throughput Start Time        | 2023-09-19 22:14:39.023 |
| Throughput End Time          | 2023-09-19 22:54:10.388 |
| Throughput Elapsed Time      | 2,371.365               |

Accuracy Metrics

| Use Case | Metric Name            | Metric | Criteria | Threshold | Status |
|----------|------------------------|--------|----------|-----------|--------|
| 1        | N/A                    | 0.000  | N/A      | 0.00      | Pass   |
| 2        | word_error_rate        | 0.348  | <=       | 0.50      | Pass   |
| 3        | mean_squared_log_error | 3.553  | <=       | 5.40      | Pass   |
| 4        | f1_score               | 0.706  | >=       | 0.65      | Pass   |
| 5        | mean_squared_log_error | 0.034  | <=       | 0.50      | Pass   |
| 6        | matthews_corrcoef      | 0.486  | >=       | 0.19      | Pass   |
| 7        | median_absolute_error  | 1.007  | <=       | 1.80      | Pass   |
| 8        | accuracy_score         | 0.754  | >=       | 0.65      | Pass   |
| 9        | accuracy_score         | 1.000  | >=       | 0.90      | Pass   |
| 10       | accuracy_score         | 0.817  | >=       | 0.70      | Pass   |

## 5.2 Throughput Test Stream Times

The following chart shows the minimum, 1<sup>st</sup> quartile, median, mean (X), 3<sup>rd</sup> quartile, and maximum stream times by use case for the Throughput Test. Outliers are marked with “o”.



## Auditor's Information

This benchmark was audited by Doug Johnson, InfoSizing.

www.sizing.com  
63 Lourdes Drive  
Leominster, MA 01453  
978-343-6562.

This benchmark's Full Disclosure Report can be downloaded from [www.tpc.org](http://www.tpc.org).

A copy of the auditor's attestation letter is included in the next two pages.



Nicholas Wakou  
 Dell Inc.  
 701 E. Parmer Ln. Bld. 2  
 Austin, TX 78753

September 22, 2023

I verified the TPC Express Benchmark™ AI v1.0.3.1 performance of the following configuration:

Platform: 1x PowerEdge R6625  
 Operating System: Red Hat Enterprise Linux 8.6 (Ootpa)  
 Additional Software: Anaconda Pro

The results were:

**Performance Metric 915.67 AIUCpm@30**

|                   |                  |        |
|-------------------|------------------|--------|
| Secondary Metrics | T <sub>LD</sub>  | 6.00   |
|                   | T <sub>PTT</sub> | 405.10 |
|                   | T <sub>PST</sub> | 25.97  |
|                   | T <sub>TT</sub>  | 2.37   |

**System Under Test 1x PowerEdge R6625 with:**

|         |                                     |             |              |
|---------|-------------------------------------|-------------|--------------|
| CPU     | 2x AMD EPYC 9374F 32-Core Processor |             |              |
| Memory  | 768 GiB                             |             |              |
| Storage | <b>Qty</b>                          | <b>Size</b> | <b>Type</b>  |
|         | 2                                   | 480 GB      | M.2 NVMe SSD |

In my opinion, these performance results were produced in compliance with the TPC requirements for the benchmark.

The following verification items were given special attention:

- All TPC-provided components were verified to be v1.0.3.1.
- All checksums were validated for compliance.
- Any modifications to shell scripts were reviewed for compliance.
- No modifications were made to any of the Java code.
- The generated dataset was properly scaled to 30 GB.
- The generated dataset used for testing was protected by RAID 1.

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- The elapsed times for all phases and runs were correctly measured and reported.
- The Storage and Memory Ratios were correctly calculated and reported.
- The system pricing was verified for major components and maintenance.
- The major pages from the FDR were verified for accuracy.

Additional Audit Notes:

None.

Respectfully Yours,

A handwritten signature in black ink that reads "Doug Johnson". The signature is fluid and cursive, with a long horizontal flourish extending to the right.

Doug Johnson, Certified TPC Auditor

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# Third-Party Price Quotes

## Anaconda



### Anaconda Support Quote

Effective Date: September 7, 2023

This is a quote for a 1 year subscription to Anaconda Pro, including support. This quote will remain valid for 120 days following the effective date listed above.

Anaconda will support the packages listed on the following page. Packages other than those listed will not be included in this support offer.

**Quote:**

\$ USD:

| Software Components                                     | Unit Price | Qty | Total Price |
|---|------------|-----|-------------|
| Anaconda Pro Subscription - 1 year with Premium Support | \$10,000   | 1   | \$10,000    |



Included packages:

| package name | source        | version |
|--------------|---------------|---------|
| conda        | main-anaconda | 23.7.2  |
| python       | main-anaconda | 3.9.18  |
| setuptools   | main-anaconda | 59.8.0  |
| pandas       | main-anaconda | 1.5.3   |
| scikit-learn | main-anaconda | 1.2.2   |
| xgboost      | main-anaconda | 1.7.4   |
| numpy        | main-anaconda | 1.23.5  |
| nose         | main-anaconda | 1.3.7   |
| scipy        | main-anaconda | 1.10.1  |
| statsmodels  | main-anaconda | 0.13.5  |
| patsy        | main-anaconda | 0.5.3   |
| tqdm         | main-anaconda | 4.65.2  |
| keras        | main-anaconda | 2.11.0  |
| tensorflow   | main-anaconda | 2.11.0  |
| joblib       | main-anaconda | 1.2.0   |
| opencv       | main-anaconda | 4.5.3   |
| pyyaml       | main-anaconda | 6.0.1   |
| matplotlib   | main-anaconda | 3.7.1   |
| jinja2       | main-anaconda | 3.1.2   |



Contact Sales: [sales@anaconda.com](mailto:sales@anaconda.com) | (512) 222-5440

Anaconda Inc.  
 1108 Lavaca Street Suite 110-645  
 Austin, TX, 78701, USA

# Supporting Files Index

The Supporting Files archive for this disclosure contains the following structure.

| Supporting Files Directory    | Description   |
|-------------------------------|---|
| CheckIntegrity/...            | Output of CHECK_INTEGRITY test (if the phase is not done as part of the Validation and Performance Test). |
| PerformanceTest/...           | Performance Test output files.  |
| ValidationTest/...            | Validation Test output files.   |
| Additional files used by Dell |   |
| Sponsor/ModelOptimization/... | Details of model optimization.  |
| Sponsor/ModifiedKitFiles/...  | 0 modified file(s).   |
| Sponsor/Tuning/...            | All tuning files used.  |