**MESA COUNTY, COLORADO, VOTING SYSTEMS**

# Forensic Analysis of Data and Processes

**Prepared by**

**Jeffrey O'Donnell – Database and Systems Analyst**

## October 10th, 2021

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## EXECUTIVE SUMMARY

This report documents data and process anomalies found during a forensic analysis of the drive image of Mesa County, Colorado's Dominion Election Management Server. These anomalies cast significant doubt as to whether Mesa County's 2020 General Election was run in a fair and legal manner.

This analysis was performed using the backup forensic image of the Election Management Server (EMS), which was saved before Dominion Voting Systems (DVS) re-imaged the County's server.

The facts presented lead to the conclusions that:

1) The true vote count in Mesa County, Colorado cannot be accurately calculated for the 2020 General Election. As such, the county's vote should be decertified.

2) Persons unknown performed actions that caused the loss of important data obscuring the source of over 5,500 ballots.

3) Processes and Practices used by the DVS Election Management software are not conducive to the running of a fair and accurate election. As such, this software should not be used for managing elections until such time as the documented security flaws are demonstrably fixed.

Evidence supporting these findings is documented in this report.

## INTRODUCTION

Use of computerized Election Management Systems is now nearly universal across counties in the United States. While the use of these systems decreases the manpower costs as well as the time taken to produce election results, it also reduces the transparency of the election process. It has been argued that the right to free and fair elections is the most important right we have as Americans, as it can be used to defend against abuses of all other rights. When votes cast by humans are counted by machines, it is a fundamental necessity that the operations and processes of those machines are transparent, auditable, and 100% accurate.

Numerous Federal and State laws exist to attempt to safeguard our elections. Title 52 USC §20701 provides for much of the Federal guidance in this area, requiring that Voting systems:

a) Comply with established 2002 Federal Election Commission Standards (CRS 1-5-601.5)
b) Preserve "any election records" for at least 22 months after an election (CRS 1-7-802)

52 USC §20701 also prescribes penalties for destroying, removing, or delaying delivery of election records. (Section 1-13-111)

The statute makes it clear that the "every officer of election" is responsible for maintaining the election records and integrity. As such, it would be irresponsible for an election officer to trust the compliance to any part of this Federal statute to an outside vendor, as it opens them up to criminal prosecution should the statute be violated by that vendor.

Mesa County, Colorado, uses software and hardware provided by Dominion Voting Systems (DVS), and for the 2020 General Election, specifically "D-Suite 5.11". The primary computer server, which contains the raw vote information used to produce official reports, makes use of Microsoft SQL Server 2016 databases running on the Microsoft Windows 2016 Server operating system. The forensic image used for the analysis, which was created on May 23, 2021, has been validated as authentic by numerous autonomous groups.
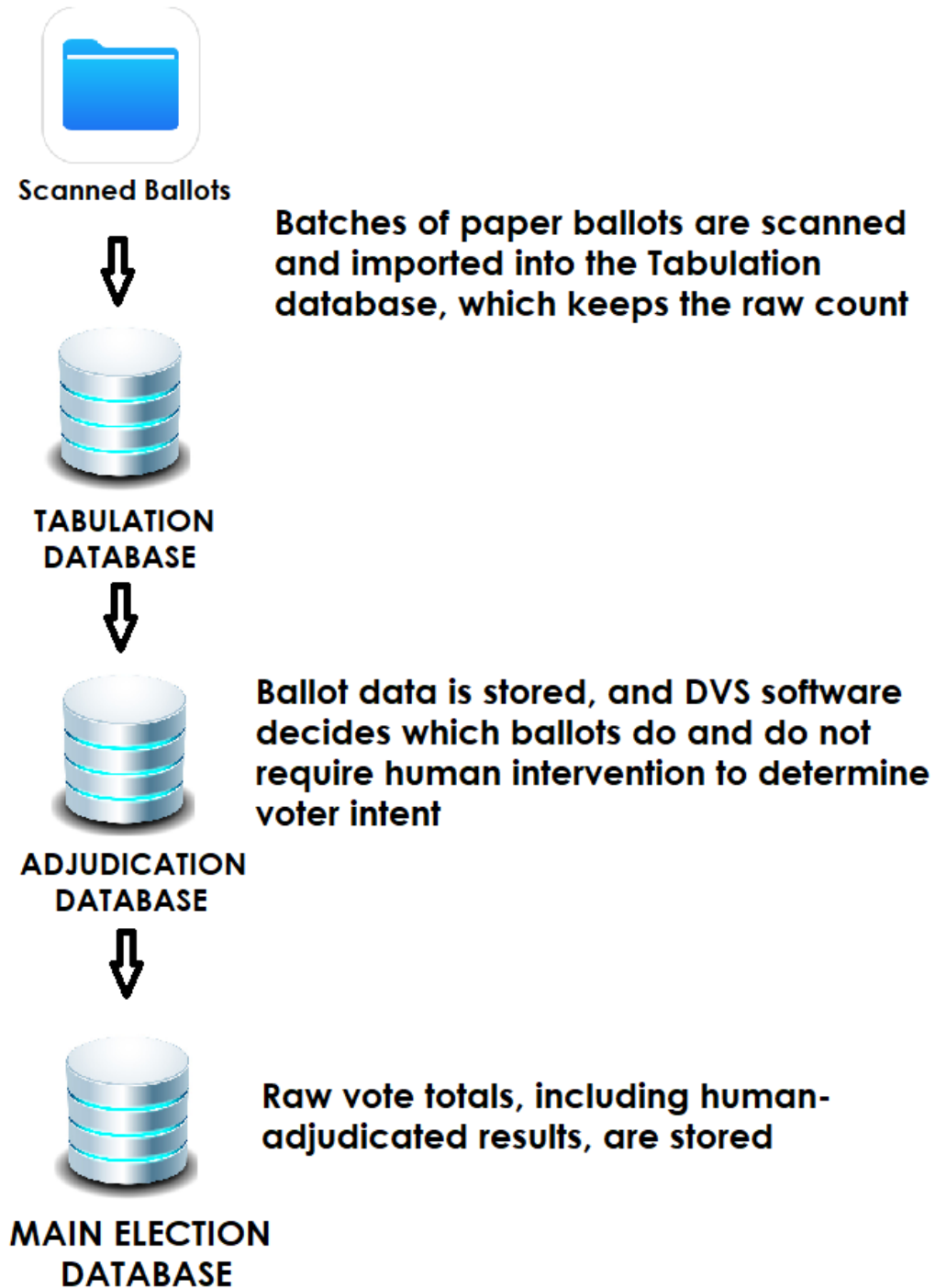
## DEFINITION OF TERMS

"Batch": Mesa County collects paper ballots in stacks of up to 100 and runs them through the tabulator, which is the hardware that digitally scans the image, Each of these stacks of ballots is called a "batch".

"Adjudication": This term means the process of determining the intent of a voter. DVS software inspects the digital image of each ballot, and checks for ovals which are properly filled in. If the software has 100% confidence in the votes marked, then the adjudication process is deemed complete.

"Manual Adjudication": Should the software not be able to determine the voter intent for any race, the ballot in question is referred to manual adjudication, a process in which ballot can be examined by humans, who together determine the voter intent and make any required changes to the ballot based upon their examination.

## DATABASE TOPOGRAPHY

The DVS Election Management System was set up in Mesa County using the following databases and vote data flow structure:

Scanned Ballots

Batches of paper ballots are scanned and imported into the Tabulation database, which keeps the raw count

TABULATION DATABASE

Ballot data is stored, and DVS software decides which ballots do and do not require human intervention to determine voter intent

ADJUDICATION DATABASE

Raw vote totals, including human-adjudicated results, are stored

MAIN ELECTION DATABASE

## RESULTS OF ANALYSIS

### 1. Data Integrity Violation, leading to uncertain results

Our analysis shows that the process of converting a ballot cast by voters into a digital data record is obfuscated during at least one part of the counting process.

To demonstrate this issue, we must give the timeline of events beginning October 19th, 2020, when Mesa County began processing ballots.

On October 19th, 85 "batches", consisting of 8,256 ballots, were scanned into the system. 799 of these were referred to manual adjudication (9.7%). These batches were serially numbered from 1 to 85 in the database.

On October 20th, 116 additional batches, consisting of 11,359 ballots, were processed. 1,128 of these ballots were referred to manual adjudication (9.9%).

On October 21st, vote data and database alteration occurred. 66 Batches, consisting of 6,298 ballots, were processed up until 2:14 PM, local time. 239 of these ballots were referred to manual adjudication (3.7%). At this time, the system shows that the following occurred:

1. New Adjudication and Tabulation databases were created. Below shows the names and dates of the original and new databases.

2. Commands were executed to copy vote data from the "old" adjudication and tabulation databases to the new ones. However, batches 2 through 59, which were among the 85 processed on October 19th, were excluded from the synchronization.

3. All of the batches copied to the "new" databases were run through the DVS adjudication step once again. Although this is a digital process which should have resulted in the same rate of manual adjudication referrals, only 965 of the 20,346 ballots in the re-run batches, 4.7%, were referred to manual adjudication this time.

The 5,567 votes which were contained in batches 2 through 59 (the specific IDs of which will be included in reference section A), were left untouched in the main election database, meaning that they are part of the officially reported election totals for the county.

This aberration in the processing of ballots is important because of how the DVS system keeps track of individual ballots. One ballot contains numerous votes, as it contains choices for many election races. In the Adjudication Database, individual ballots are stored along with the file location of their scanned image. Only the batch and vote information are sent to the Main Election Database, meaning that should it ever be desired to track a vote back to its individual ballot, that search has to go back through a table in the Adjudication database. Because information about batches 2-59 was not copied to the operating Adjudication database, this linkage would be impossible. Manual adjudication events for any of these ballots will likewise be unavailable.

There is also no way of determining if the 25,913 ballots processed before the database switch contain the same information as the 25,913 ballots processed afterwards.

The low manual adjudication rate on October 21st is also a significant finding. Although we do not have access to the scanning hardware and its software, it appears that the settings were changed on the 21st,

which would account for the lower manual adjudication rate. However, all ballots scanned after the database switch were manually adjudicated at a rate of more than 11 percent. Thus, the lower manual adjudication rate on that one day of processing is unexplained.

If the reasons behind these findings cannot be adequately explained, then the county's election results are indeterminate and must be decertified.  We cannot determine, due to the purging of database logs, the exact process by which this vote alteration was performed, or the entity who performed it. However, in our opinion, the knowledge necessary to perform these actions would not generally exist in County Election personnel, unless they were being guided by someone with significant knowledge of the system.

The net effect is that over 5% of the County's total reported vote is suspicious and cannot be validated.

## 2. Intentional purging of Log Files

In examining the drive image, we found that nearly every critical file used to save logs of events which occur in the server have been set to a very low size (typically 10 megabytes), meaning that only the last few days of events are stored. This is not the default behavior of the operating system or database server. This left us, and anyone else who wanted to effectively audit the actions taken during the election period, unable to view any of these events.

The logs which are regularly purged are:

a. Standard Windows Event logs, including the System, Application, and Services log, which would show all applications run and errors encountered.

b. Networking logs, which would show connection to the server from other computers.

c. Windows Defender anti-virus and anti-malware logs, which would show malware intrusion into the server. Of note, an analysis of the deleted files on the system show that Windows Defender logs were often manually deleted.

d. Microsoft SQL Server logs, which would show database activity and the processed which caused that activity.

All of these logs should be considered under the category "all election records", as the DVS Election Management System is running on the Windows operating system, uses the SQL Server database application to store and manipulate election data, and uses Windows Defender as its only mitigation against malware intrusion. In our opinion, the planned purging of this log information is a breach of the Federal 22 month data retention laws.

## 3. Evidence of Connection to both local Intranet and External Internet

DVS claims that its Election Servers are "air gapped", and incapable of being remotely accessed. We found direct evidence that the Mesa County server is connected to other computers in a local intranet. For instance, the fact that the server retrieves information from an external system to retrieve the ballot data indicates that there is a connection. If this intranet is connected via a router, then that router could provide access to the internet or other networks locally.

The following facts should be investigated:

a. A network card is active on the server

b. Microsoft SQL Server is configured to "listen" on the interface, meaning that someone with access and credentials could do any database alteration they desired.

c. Microsoft Report Server reports which exist on the server, which match the formatting and style of the official reports on Mesa County's websites, require an internet connection to be run. Specifically, they attempt to connect with Microsoft's Azure services, and produce an error if they are unable.

It is important to recognize that system intrusions can occur just as easily from other local computers as they can from systems on the internet. Many virus and malware applications are designed to "hop" from system to system via any local network to which they are connected.

## 4. Lack of Software Updates

Microsoft Windows Server and Microsoft SQL Server are regularly updated to address the latest virus and malware exploits. The server used in Mesa County had not had a Windows Update since June 10th, 2019. In the time between June 10th, 2019 and October 19th, 2020, there were dozens of critical updates addressing hundreds of issues which could cause everything from data exposure to remote software execution to complete loss of data.

This shows, in our opinion, a disregard for the integrity of the data on the Election Management Server.

## 5. Existence of SQL Server Management Studio

Microsoft SQL Server can be managed at a very low level by a tool called "SQL Server Management Studio" (SSMS). We found that not only is this tool, which can be used by anyone with access to the server

to change or delete any election data, installed on the server, DVS user manuals actually instruct election personnel to utilize it to perform certain database tasks. The existence of this tool on the server opens up the system to accidental and intentional data changes which would leave no trail whatsoever.

## 6. Lack of Referential Integrity in DVS Database Tables

Most modern database designs include a concept called "referential integrity". For example, if you have one table of data that has information about a person, and another table that has information about colleges, you might have a field in the person's table that can contain an id, or pointer, to the college he went to. Referentially integrity in this case would mean that if John Smith's record had a pointer to the University of Pittsburgh, the system should give an error should you try to remove the item "University of Pittsburgh" from the colleges table. It would not allow you to do this action because something else "refers" to the college.

The DVS Election Management System data structures have no such integrity built into them. This is why batch records in the one database could be deleted without any consequence to records that point to that batch in another database. This lack of referential integrity means that vote information could easily be added or removed from one part of the database without any warnings or errors occurring in other parts of the database.

## CONCLUSIONS

1. As we have found evidence that a large number of ballots have had their source placed in serious question, none of the election results from Mesa County can be considered trustworthy, and the 2020 General Election in that county should be decertified.

2. A hand audit of all physical ballots in Mesa County, and their corresponding envelopes, should be performed. This audit should focus first on the ballots reportedly contained in the 58 missing batches.

3. The hard-drive data from any county using DVS to manage their elections should forensically preserved and examined to determine if evidence of data alteration exists.

4. Because of the serious security concerns outlined, DVS should not be used to manage future elections until the issues outlined above are explained and remedied.

# REFERENCE A – MESA COUNTY BATCHES

This lists all batches of ballots processed before the database switch described above, along with the reprocessing time. The batches which were reprocessed after the database switch are highlighted in Yellow. The batches which were *not* reprocessed after the database switch are highlighted in Red. All times are local to Mesa County, Colorado.

| Batch ID | Initial Processing | 2nd Processing | Tabulator | Votes |
|---|---|---|---|---|
| 4001 | 10/19/20 12:07 PM | 10/21/20 2:20 PM | Tabulator 10 - Batch 4001 | 100 |
| 4002 | 10/19/20 12:07 PM | | Tabulator 10 - Batch 4002 | 42 |
| 4003 | 10/19/20 12:07 PM | | Tabulator 10 - Batch 4003 | 100 |
| 4004 | 10/19/20 12:07 PM | | Tabulator 10 - Batch 4004 | 100 |
| 4005 | 10/19/20 12:07 PM | | Tabulator 10 - Batch 4005 | 100 |
| 4006 | 10/19/20 12:08 PM | | Tabulator 10 - Batch 4006 | 100 |
| 4007 | 10/19/20 12:08 PM | | Tabulator 10 - Batch 4007 | 100 |
| 4008 | 10/19/20 12:08 PM | | Tabulator 10 - Batch 4008 | 99 |
| 4009 | 10/19/20 12:08 PM | | Tabulator 10 - Batch 4009 | 100 |
| 4010 | 10/19/20 12:08 PM | | Tabulator 10 - Batch 4010 | 100 |
| 2001 | 10/19/20 12:23 PM | | Tabulator 4 - Batch 2001 | 98 |
| 2002 | 10/19/20 12:30 PM | | Tabulator 4 - Batch 2002 | 100 |
| 2003 | 10/19/20 12:32 PM | | Tabulator 4 - Batch 2003 | 100 |
| 2004 | 10/19/20 12:36 PM | | Tabulator 4 - Batch 2004 | 100 |
| 2005 | 10/19/20 12:43 PM | | Tabulator 4 - Batch 2005 | 100 |
| 2006 | 10/19/20 1:50 PM | | Tabulator 4 - Batch 2006 | 100 |
| 2007 | 10/19/20 1:54 PM | | Tabulator 4 - Batch 2007 | 100 |
| 2008 | 10/19/20 1:58 PM | | Tabulator 4 - Batch 2008 | 100 |
| 2009 | 10/19/20 2:03 PM | | Tabulator 4 - Batch 2009 | 100 |
| 2010 | 10/19/20 2:06 PM | | Tabulator 4 - Batch 2010 | 100 |
| 2011 | 10/19/20 2:10 PM | | Tabulator 4 - Batch 2011 | 99 |
| 2012 | 10/19/20 2:14 PM | | Tabulator 4 - Batch 2012 | 100 |
| 2013 | 10/19/20 2:18 PM | | Tabulator 4 - Batch 2013 | 100 |
| 2014 | 10/19/20 2:22 PM | | Tabulator 4 - Batch 2014 | 100 |
| 2015 | 10/19/20 2:26 PM | | Tabulator 4 - Batch 2015 | 100 |
| 2016 | 10/19/20 2:30 PM | | Tabulator 4 - Batch 2016 | 100 |
| 2017 | 10/19/20 2:34 PM | | Tabulator 4 - Batch 2017 | 100 |
| 2018 | 10/19/20 2:36 PM | | Tabulator 4 - Batch 2018 | 33 |
| 2019 | 10/19/20 2:40 PM | | Tabulator 4 - Batch 2019 | 100 |
| 2020 | 10/19/20 2:44 PM | | Tabulator 4 - Batch 2020 | 100 |
| 2021 | 10/19/20 2:48 PM | | Tabulator 4 - Batch 2021 | 99 |
| 2022 | 10/19/20 2:51 PM | | Tabulator 4 - Batch 2022 | 100 |

| | | | | |
|---|---|---|---|---|
| 2023 | 10/19/20 2:57 PM | | Tabulator 4 - Batch 2023 | 99 |
| 2024 | 10/19/20 2:59 PM | | Tabulator 4 - Batch 2024 | 100 |
| 4011 | 10/19/20 3:05 PM | | Tabulator 10 - Batch 4011 | 100 |
| 2025 | 10/19/20 3:06 PM | | Tabulator 4 - Batch 2025 | 100 |
| 4012 | 10/19/20 3:09 PM | | Tabulator 10 - Batch 4012 | 100 |
| 2026 | 10/19/20 3:10 PM | | Tabulator 4 - Batch 2026 | 99 |
| 4013 | 10/19/20 3:12 PM | | Tabulator 10 - Batch 4013 | 100 |
| 2027 | 10/19/20 3:15 PM | | Tabulator 4 - Batch 2027 | 100 |
| 4014 | 10/19/20 3:16 PM | | Tabulator 10 - Batch 4014 | 100 |
| 2028 | 10/19/20 3:17 PM | | Tabulator 4 - Batch 2028 | 100 |
| 2029 | 10/19/20 3:19 PM | | Tabulator 4 - Batch 2029 | 25 |
| 2030 | 10/19/20 3:22 PM | | Tabulator 4 - Batch 2030 | 100 |
| 4015 | 10/19/20 3:24 PM | | Tabulator 10 - Batch 4015 | 99 |
| 2031 | 10/19/20 3:29 PM | | Tabulator 4 - Batch 2031 | 100 |
| 4016 | 10/19/20 3:30 PM | | Tabulator 10 - Batch 4016 | 100 |
| 2032 | 10/19/20 3:34 PM | | Tabulator 4 - Batch 2032 | 99 |
| 4017 | 10/19/20 3:34 PM | | Tabulator 10 - Batch 4017 | 100 |
| 4018 | 10/19/20 3:40 PM | | Tabulator 10 - Batch 4018 | 100 |
| 4019 | 10/19/20 3:44 PM | | Tabulator 10 - Batch 4019 | 100 |
| 4020 | 10/19/20 3:48 PM | | Tabulator 10 - Batch 4020 | 99 |
| 2033 | 10/19/20 4:00 PM | | Tabulator 4 - Batch 2033 | 100 |
| 4021 | 10/19/20 4:00 PM | | Tabulator 10 - Batch 4021 | 99 |
| 2034 | 10/19/20 4:03 PM | | Tabulator 4 - Batch 2034 | 100 |
| 4022 | 10/19/20 4:03 PM | | Tabulator 10 - Batch 4022 | 100 |
| 4023 | 10/19/20 4:05 PM | | Tabulator 10 - Batch 4023 | 78 |
| 2035 | 10/19/20 4:09 PM | | Tabulator 4 - Batch 2035 | 100 |
| 4024 | 10/19/20 4:09 PM | | Tabulator 10 - Batch 4024 | 100 |
| 4025 | 10/19/20 4:12 PM | 10/21/20 2:20 PM | Tabulator 10 - Batch 4025 | 99 |
| 2036 | 10/19/20 4:13 PM | 10/21/20 2:20 PM | Tabulator 4 - Batch 2036 | 100 |
| 4026 | 10/19/20 4:15 PM | 10/21/20 2:20 PM | Tabulator 10 - Batch 4026 | 100 |
| 2037 | 10/19/20 4:16 PM | 10/21/20 2:20 PM | Tabulator 4 - Batch 2037 | 99 |
| 4027 | 10/19/20 4:19 PM | 10/21/20 2:20 PM | Tabulator 10 - Batch 4027 | 100 |
| 4028 | 10/19/20 4:22 PM | 10/21/20 2:20 PM | Tabulator 10 - Batch 4028 | 100 |
| 2038 | 10/19/20 4:24 PM | 10/21/20 2:20 PM | Tabulator 4 - Batch 2038 | 100 |
| 2039 | 10/19/20 4:28 PM | 10/21/20 2:20 PM | Tabulator 4 - Batch 2039 | 100 |
| 2040 | 10/19/20 4:32 PM | 10/21/20 2:21 PM | Tabulator 4 - Batch 2040 | 100 |
| 2041 | 10/19/20 4:35 PM | 10/21/20 2:21 PM | Tabulator 4 - Batch 2041 | 100 |
| 4029 | 10/19/20 4:37 PM | 10/21/20 2:21 PM | Tabulator 10 - Batch 4029 | 100 |
| 2042 | 10/19/20 4:41 PM | 10/21/20 2:21 PM | Tabulator 4 - Batch 2042 | 99 |
| 4030 | 10/19/20 4:41 PM | 10/21/20 2:21 PM | Tabulator 10 - Batch 4030 | 99 |
| 2043 | 10/19/20 4:46 PM | 10/21/20 2:21 PM | Tabulator 4 - Batch 2043 | 100 |
| 4031 | 10/19/20 4:49 PM | 10/21/20 2:21 PM | Tabulator 10 - Batch 4031 | 97 |

| | | | | |
|---|---|---|---|---|
| 4032 | 10/19/20 4:53 PM | 10/21/20 2:21 PM | Tabulator 10 - Batch 4032 | 99 |
| 4033 | 10/19/20 4:55 PM | 10/21/20 2:21 PM | Tabulator 10 - Batch 4033 | 100 |
| 2044 | 10/19/20 4:57 PM | 10/21/20 2:21 PM | Tabulator 4 - Batch 2044 | 100 |
| 4034 | 10/19/20 4:58 PM | 10/21/20 2:21 PM | Tabulator 10 - Batch 4034 | 100 |
| 2045 | 10/19/20 5:00 PM | 10/21/20 2:21 PM | Tabulator 4 - Batch 2045 | 99 |
| 4035 | 10/19/20 5:03 PM | 10/21/20 2:21 PM | Tabulator 10 - Batch 4035 | 100 |
| 4036 | 10/19/20 5:06 PM | 10/21/20 2:21 PM | Tabulator 10 - Batch 4036 | 100 |
| 2046 | 10/19/20 5:16 PM | 10/21/20 2:22 PM | Tabulator 4 - Batch 2046 | 99 |
| 2047 | 10/19/20 5:18 PM | 10/21/20 2:22 PM | Tabulator 4 - Batch 2047 | 100 |
| 4037 | 10/19/20 5:18 PM | 10/21/20 2:22 PM | Tabulator 10 - Batch 4037 | 100 |
| 2048 | 10/19/20 5:22 PM | 10/21/20 2:22 PM | Tabulator 4 - Batch 2048 | 99 |
| 2049 | 10/20/20 10:05 AM | 10/21/20 2:22 PM | Tabulator 4 - Batch 2049 | 100 |
| 2050 | 10/20/20 10:07 AM | 10/21/20 2:22 PM | Tabulator 4 - Batch 2050 | 100 |
| 2051 | 10/20/20 10:10 AM | 10/21/20 2:22 PM | Tabulator 4 - Batch 2051 | 99 |
| 2052 | 10/20/20 10:13 AM | 10/21/20 2:22 PM | Tabulator 4 - Batch 2052 | 100 |
| 2053 | 10/20/20 10:17 AM | 10/21/20 2:22 PM | Tabulator 4 - Batch 2053 | 100 |
| 2054 | 10/20/20 10:29 AM | 10/21/20 2:22 PM | Tabulator 4 - Batch 2054 | 100 |
| 2055 | 10/20/20 10:32 AM | 10/21/20 2:22 PM | Tabulator 4 - Batch 2055 | 100 |
| 2056 | 10/20/20 10:40 AM | 10/21/20 2:22 PM | Tabulator 4 - Batch 2056 | 100 |
| 2057 | 10/20/20 10:43 AM | 10/21/20 2:22 PM | Tabulator 4 - Batch 2057 | 100 |
| 2058 | 10/20/20 10:50 AM | 10/21/20 2:22 PM | Tabulator 4 - Batch 2058 | 99 |
| 2059 | 10/20/20 10:53 AM | 10/21/20 2:22 PM | Tabulator 4 - Batch 2059 | 100 |
| 2060 | 10/20/20 10:56 AM | 10/21/20 2:23 PM | Tabulator 4 - Batch 2060 | 100 |
| 2061 | 10/20/20 10:59 AM | 10/21/20 2:23 PM | Tabulator 4 - Batch 2061 | 100 |
| 2062 | 10/20/20 11:02 AM | 10/21/20 2:23 PM | Tabulator 4 - Batch 2062 | 98 |
| 2063 | 10/20/20 11:05 AM | 10/21/20 2:23 PM | Tabulator 4 - Batch 2063 | 100 |
| 2064 | 10/20/20 11:08 AM | 10/21/20 2:23 PM | Tabulator 4 - Batch 2064 | 100 |
| 2065 | 10/20/20 11:11 AM | 10/21/20 2:23 PM | Tabulator 4 - Batch 2065 | 100 |
| 2066 | 10/20/20 11:16 AM | 10/21/20 2:23 PM | Tabulator 4 - Batch 2066 | 100 |
| 2067 | 10/20/20 11:19 AM | 10/21/20 2:23 PM | Tabulator 4 - Batch 2067 | 100 |
| 2068 | 10/20/20 11:22 AM | 10/21/20 2:23 PM | Tabulator 4 - Batch 2068 | 100 |
| 2069 | 10/20/20 11:26 AM | 10/21/20 2:23 PM | Tabulator 4 - Batch 2069 | 99 |
| 2070 | 10/20/20 11:30 AM | 10/21/20 2:23 PM | Tabulator 4 - Batch 2070 | 94 |
| 2071 | 10/20/20 11:33 AM | 10/21/20 2:23 PM | Tabulator 4 - Batch 2071 | 100 |
| 2072 | 10/20/20 11:38 AM | 10/21/20 2:23 PM | Tabulator 4 - Batch 2072 | 100 |
| 2073 | 10/20/20 11:43 AM | 10/21/20 2:23 PM | Tabulator 4 - Batch 2073 | 100 |
| 4038 | 10/20/20 11:43 AM | 10/21/20 2:24 PM | Tabulator 10 - Batch 4038 | 99 |
| 4039 | 10/20/20 11:48 AM | 10/21/20 2:24 PM | Tabulator 10 - Batch 4039 | 100 |
| 4040 | 10/20/20 11:50 AM | 10/21/20 2:24 PM | Tabulator 10 - Batch 4040 | 99 |
| 2074 | 10/20/20 11:52 AM | 10/21/20 2:24 PM | Tabulator 4 - Batch 2074 | 99 |
| 4041 | 10/20/20 11:55 AM | 10/21/20 2:24 PM | Tabulator 10 - Batch 4041 | 100 |
| 2075 | 10/20/20 11:56 AM | 10/21/20 2:24 PM | Tabulator 4 - Batch 2075 | 99 |

| | | | | |
|---|---|---|---|---|
| 4042 | 10/20/20 11:58 AM | 10/21/20 2:24 PM | Tabulator 10 - Batch 4042 | 100 |
| 4043 | 10/20/20 12:02 PM | 10/21/20 2:24 PM | Tabulator 10 - Batch 4043 | 100 |
| 4044 | 10/20/20 12:05 PM | 10/21/20 2:24 PM | Tabulator 10 - Batch 4044 | 100 |
| 2076 | 10/20/20 12:07 PM | 10/21/20 2:24 PM | Tabulator 4 - Batch 2076 | 100 |
| 2077 | 10/20/20 12:13 PM | 10/21/20 2:24 PM | Tabulator 4 - Batch 2077 | 100 |
| 4045 | 10/20/20 12:13 PM | 10/21/20 2:24 PM | Tabulator 10 - Batch 4045 | 100 |
| 2078 | 10/20/20 12:16 PM | 10/21/20 2:24 PM | Tabulator 4 - Batch 2078 | 99 |
| 4046 | 10/20/20 12:16 PM | 10/21/20 2:24 PM | Tabulator 10 - Batch 4046 | 100 |
| 2079 | 10/20/20 12:19 PM | 10/21/20 2:25 PM | Tabulator 4 - Batch 2079 | 99 |
| 4047 | 10/20/20 12:19 PM | 10/21/20 2:25 PM | Tabulator 10 - Batch 4047 | 99 |
| 2080 | 10/20/20 12:22 PM | 10/21/20 2:25 PM | Tabulator 4 - Batch 2080 | 99 |
| 4048 | 10/20/20 12:22 PM | 10/21/20 2:25 PM | Tabulator 10 - Batch 4048 | 100 |
| 2081 | 10/20/20 12:25 PM | 10/21/20 2:25 PM | Tabulator 4 - Batch 2081 | 100 |
| 4049 | 10/20/20 12:30 PM | 10/21/20 2:25 PM | Tabulator 10 - Batch 4049 | 100 |
| 2082 | 10/20/20 1:08 PM | 10/21/20 2:25 PM | Tabulator 4 - Batch 2082 | 100 |
| 4050 | 10/20/20 1:11 PM | 10/21/20 2:25 PM | Tabulator 10 - Batch 4050 | 100 |
| 2083 | 10/20/20 1:14 PM | 10/21/20 2:25 PM | Tabulator 4 - Batch 2083 | 100 |
| 4051 | 10/20/20 1:14 PM | 10/21/20 2:25 PM | Tabulator 10 - Batch 4051 | 100 |
| 2084 | 10/20/20 1:16 PM | 10/21/20 2:25 PM | Tabulator 4 - Batch 2084 | 100 |
| 4052 | 10/20/20 1:18 PM | 10/21/20 2:25 PM | Tabulator 10 - Batch 4052 | 100 |
| 2085 | 10/20/20 1:20 PM | 10/21/20 2:25 PM | Tabulator 4 - Batch 2085 | 100 |
| 4053 | 10/20/20 1:21 PM | 10/21/20 2:25 PM | Tabulator 10 - Batch 4053 | 100 |
| 2086 | 10/20/20 1:22 PM | 10/21/20 2:26 PM | Tabulator 4 - Batch 2086 | 100 |
| 4054 | 10/20/20 1:27 PM | 10/21/20 2:26 PM | Tabulator 10 - Batch 4054 | 100 |
| 4055 | 10/20/20 1:31 PM | 10/21/20 2:26 PM | Tabulator 10 - Batch 4055 | 100 |
| 2087 | 10/20/20 1:33 PM | 10/21/20 2:26 PM | Tabulator 4 - Batch 2087 | 98 |
| 2088 | 10/20/20 1:37 PM | 10/21/20 2:26 PM | Tabulator 4 - Batch 2088 | 100 |
| 4056 | 10/20/20 1:47 PM | 10/21/20 2:26 PM | Tabulator 10 - Batch 4056 | 97 |
| 2089 | 10/20/20 1:53 PM | 10/21/20 2:26 PM | Tabulator 4 - Batch 2089 | 100 |
| 2090 | 10/20/20 1:58 PM | 10/21/20 2:26 PM | Tabulator 4 - Batch 2090 | 99 |
| 4057 | 10/20/20 2:02 PM | 10/21/20 2:26 PM | Tabulator 10 - Batch 4057 | 96 |
| 2091 | 10/20/20 2:04 PM | 10/21/20 2:26 PM | Tabulator 4 - Batch 2091 | 100 |
| 2092 | 10/20/20 2:07 PM | 10/21/20 2:26 PM | Tabulator 4 - Batch 2092 | 100 |
| 4058 | 10/20/20 2:07 PM | 10/21/20 2:26 PM | Tabulator 10 - Batch 4058 | 97 |
| 2093 | 10/20/20 2:10 PM | 10/21/20 2:26 PM | Tabulator 4 - Batch 2093 | 100 |
| 2094 | 10/20/20 2:14 PM | 10/21/20 2:26 PM | Tabulator 4 - Batch 2094 | 100 |
| 2095 | 10/20/20 2:19 PM | 10/21/20 2:26 PM | Tabulator 4 - Batch 2095 | 97 |
| 2096 | 10/20/20 2:23 PM | 10/21/20 2:27 PM | Tabulator 4 - Batch 2096 | 99 |
| 3001 | 10/20/20 2:26 PM | 10/21/20 2:27 PM | Tabulator 7 - Batch 3001 | 100 |
| 3002 | 10/20/20 2:29 PM | 10/21/20 2:27 PM | Tabulator 7 - Batch 3002 | 100 |
| 2097 | 10/20/20 2:31 PM | 10/21/20 2:27 PM | Tabulator 4 - Batch 2097 | 100 |
| 3003 | 10/20/20 2:32 PM | 10/21/20 2:27 PM | Tabulator 7 - Batch 3003 | 100 |

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| 3004 | 10/20/20 2:36 PM | 10/21/20 2:27 PM | Tabulator 7 - Batch 3004 | 98 |
| 2098 | 10/20/20 2:38 PM | 10/21/20 2:27 PM | Tabulator 4 - Batch 2098 | 100 |
| 3005 | 10/20/20 2:39 PM | 10/21/20 2:27 PM | Tabulator 7 - Batch 3005 | 98 |
| 2099 | 10/20/20 2:42 PM | 10/21/20 2:27 PM | Tabulator 4 - Batch 2099 | 99 |
| 3006 | 10/20/20 2:43 PM | 10/21/20 2:27 PM | Tabulator 7 - Batch 3006 | 100 |
| 2100 | 10/20/20 2:46 PM | 10/21/20 2:27 PM | Tabulator 4 - Batch 2100 | 100 |
| 3007 | 10/20/20 2:47 PM | 10/21/20 2:27 PM | Tabulator 7 - Batch 3007 | 100 |
| 2101 | 10/20/20 2:49 PM | 10/21/20 2:27 PM | Tabulator 4 - Batch 2101 | 100 |
| 3008 | 10/20/20 2:51 PM | 10/21/20 2:27 PM | Tabulator 7 - Batch 3008 | 100 |
| 2102 | 10/20/20 2:57 PM | 10/21/20 2:28 PM | Tabulator 4 - Batch 2102 | 97 |
| 3009 | 10/20/20 2:57 PM | 10/21/20 2:28 PM | Tabulator 7 - Batch 3009 | 95 |
| 2103 | 10/20/20 3:00 PM | 10/21/20 2:28 PM | Tabulator 4 - Batch 2103 | 99 |
| 3010 | 10/20/20 3:01 PM | 10/21/20 2:28 PM | Tabulator 7 - Batch 3010 | 99 |
| 2104 | 10/20/20 3:04 PM | 10/21/20 2:28 PM | Tabulator 4 - Batch 2104 | 99 |
| 3011 | 10/20/20 3:04 PM | 10/21/20 2:28 PM | Tabulator 7 - Batch 3011 | 98 |
| 2105 | 10/20/20 3:07 PM | 10/21/20 2:28 PM | Tabulator 4 - Batch 2105 | 100 |
| 3012 | 10/20/20 3:07 PM | 10/21/20 2:28 PM | Tabulator 7 - Batch 3012 | 100 |
| 3013 | 10/20/20 3:10 PM | 10/21/20 2:28 PM | Tabulator 7 - Batch 3013 | 98 |
| 2106 | 10/20/20 3:12 PM | 10/21/20 2:28 PM | Tabulator 4 - Batch 2106 | 95 |
| 3014 | 10/20/20 3:13 PM | 10/21/20 2:28 PM | Tabulator 7 - Batch 3014 | 100 |
| 2107 | 10/20/20 3:21 PM | 10/21/20 2:28 PM | Tabulator 4 - Batch 2107 | 95 |
| 3015 | 10/20/20 3:23 PM | 10/21/20 2:28 PM | Tabulator 7 - Batch 3015 | 94 |
| 2108 | 10/20/20 3:25 PM | 10/21/20 2:28 PM | Tabulator 4 - Batch 2108 | 100 |
| 3016 | 10/20/20 3:25 PM | 10/21/20 2:28 PM | Tabulator 7 - Batch 3016 | 100 |
| 3017 | 10/20/20 3:29 PM | 10/21/20 2:29 PM | Tabulator 7 - Batch 3017 | 100 |
| 2109 | 10/20/20 3:30 PM | 10/21/20 2:29 PM | Tabulator 4 - Batch 2109 | 94 |
| 3018 | 10/20/20 3:35 PM | 10/21/20 2:29 PM | Tabulator 7 - Batch 3018 | 97 |
| 3019 | 10/20/20 3:59 PM | 10/21/20 2:29 PM | Tabulator 7 - Batch 3019 | 95 |
| 1001 | 10/20/20 4:02 PM | 10/21/20 2:29 PM | Tabulator 2 - Batch 1001 | 75 |
| 3020 | 10/20/20 4:03 PM | 10/21/20 2:29 PM | Tabulator 7 - Batch 3020 | 99 |
| 3021 | 10/20/20 4:06 PM | 10/21/20 2:29 PM | Tabulator 7 - Batch 3021 | 99 |
| 3022 | 10/20/20 4:10 PM | 10/21/20 2:29 PM | Tabulator 7 - Batch 3022 | 99 |
| 3023 | 10/20/20 4:13 PM | 10/21/20 2:29 PM | Tabulator 7 - Batch 3023 | 100 |
| 3024 | 10/20/20 4:22 PM | 10/21/20 2:29 PM | Tabulator 7 - Batch 3024 | 99 |
| 2110 | 10/20/20 4:24 PM | 10/21/20 2:29 PM | Tabulator 4 - Batch 2110 | 98 |
| 3025 | 10/20/20 4:26 PM | 10/21/20 2:29 PM | Tabulator 7 - Batch 3025 | 100 |
| 2111 | 10/20/20 4:28 PM | 10/21/20 2:29 PM | Tabulator 4 - Batch 2111 | 100 |
| 3026 | 10/20/20 4:29 PM | 10/21/20 2:29 PM | Tabulator 7 - Batch 3026 | 100 |
| 3027 | 10/20/20 4:34 PM | 10/21/20 2:30 PM | Tabulator 7 - Batch 3027 | 100 |
| 3028 | 10/20/20 4:38 PM | 10/21/20 2:30 PM | Tabulator 7 - Batch 3028 | 100 |
| 1002 | 10/20/20 4:46 PM | 10/21/20 2:30 PM | Tabulator 2 - Batch 1002 | 21 |
| 1003 | 10/20/20 4:56 PM | 10/21/20 2:30 PM | Tabulator 2 - Batch 1003 | 75 |

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| 1004 | 10/20/20 4:57 PM | 10/21/20 2:30 PM | Tabulator 2 - Batch 1004 | 80 |
| 2112 | 10/21/20 9:05 AM | 10/21/20 2:30 PM | Tabulator 4 - Batch 2112 | 99 |
| 2113 | 10/21/20 9:07 AM | 10/21/20 2:30 PM | Tabulator 4 - Batch 2113 | 95 |
| 2114 | 10/21/20 9:10 AM | 10/21/20 2:30 PM | Tabulator 4 - Batch 2114 | 98 |
| 2115 | 10/21/20 9:14 AM | 10/21/20 2:30 PM | Tabulator 4 - Batch 2115 | 96 |
| 2116 | 10/21/20 9:18 AM | 10/21/20 2:30 PM | Tabulator 4 - Batch 2116 | 99 |
| 2117 | 10/21/20 9:20 AM | 10/21/20 2:30 PM | Tabulator 4 - Batch 2117 | 100 |
| 2118 | 10/21/20 9:22 AM | 10/21/20 2:30 PM | Tabulator 4 - Batch 2118 | 100 |
| 2119 | 10/21/20 9:28 AM | 10/21/20 2:30 PM | Tabulator 4 - Batch 2119 | 100 |
| 2120 | 10/21/20 9:33 AM | 10/21/20 2:30 PM | Tabulator 4 - Batch 2120 | 100 |
| 2121 | 10/21/20 9:36 AM | 10/21/20 2:30 PM | Tabulator 4 - Batch 2121 | 100 |
| 2122 | 10/21/20 9:39 AM | 10/21/20 2:30 PM | Tabulator 4 - Batch 2122 | 100 |
| 2123 | 10/21/20 9:42 AM | 10/21/20 2:31 PM | Tabulator 4 - Batch 2123 | 100 |
| 1005 | 10/21/20 9:50 AM | 10/21/20 2:31 PM | Tabulator 2 - Batch 1005 | 68 |
| 1006 | 10/21/20 9:54 AM | 10/21/20 2:31 PM | Tabulator 2 - Batch 1006 | 37 |
| 1007 | 10/21/20 9:56 AM | 10/21/20 2:31 PM | Tabulator 2 - Batch 1007 | 76 |
| 1008 | 10/21/20 10:14 AM | 10/21/20 2:31 PM | Tabulator 2 - Batch 1008 | 14 |
| 4059 | 10/21/20 10:16 AM | 10/21/20 2:31 PM | Tabulator 10 - Batch 4059 | 100 |
| 4060 | 10/21/20 10:25 AM | 10/21/20 2:31 PM | Tabulator 10 - Batch 4060 | 100 |
| 4061 | 10/21/20 10:28 AM | 10/21/20 2:31 PM | Tabulator 10 - Batch 4061 | 100 |
| 4062 | 10/21/20 10:32 AM | 10/21/20 2:31 PM | Tabulator 10 - Batch 4062 | 98 |
| 4063 | 10/21/20 10:34 AM | 10/21/20 2:31 PM | Tabulator 10 - Batch 4063 | 100 |
| 4064 | 10/21/20 10:37 AM | 10/21/20 2:31 PM | Tabulator 10 - Batch 4064 | 100 |
| 4065 | 10/21/20 10:40 AM | 10/21/20 2:31 PM | Tabulator 10 - Batch 4065 | 100 |
| 4066 | 10/21/20 10:43 AM | 10/21/20 2:31 PM | Tabulator 10 - Batch 4066 | 100 |
| 4067 | 10/21/20 10:47 AM | 10/21/20 2:31 PM | Tabulator 10 - Batch 4067 | 99 |
| 4068 | 10/21/20 10:51 AM | 10/21/20 2:31 PM | Tabulator 10 - Batch 4068 | 100 |
| 4069 | 10/21/20 10:56 AM | 10/21/20 2:31 PM | Tabulator 10 - Batch 4069 | 100 |
| 4070 | 10/21/20 10:59 AM | 10/21/20 2:32 PM | Tabulator 10 - Batch 4070 | 100 |
| 4071 | 10/21/20 11:02 AM | 10/21/20 2:32 PM | Tabulator 10 - Batch 4071 | 99 |
| 4072 | 10/21/20 11:05 AM | 10/21/20 2:32 PM | Tabulator 10 - Batch 4072 | 100 |
| 4073 | 10/21/20 11:21 AM | 10/21/20 2:32 PM | Tabulator 10 - Batch 4073 | 100 |
| 4074 | 10/21/20 11:27 AM | 10/21/20 2:32 PM | Tabulator 10 - Batch 4074 | 100 |
| 4075 | 10/21/20 11:35 AM | 10/21/20 2:32 PM | Tabulator 10 - Batch 4075 | 97 |
| 4076 | 10/21/20 11:38 AM | 10/21/20 2:32 PM | Tabulator 10 - Batch 4076 | 100 |
| 4077 | 10/21/20 11:41 AM | 10/21/20 2:32 PM | Tabulator 10 - Batch 4077 | 100 |
| 4078 | 10/21/20 11:46 AM | 10/21/20 2:32 PM | Tabulator 10 - Batch 4078 | 100 |
| 4079 | 10/21/20 11:49 AM | 10/21/20 2:32 PM | Tabulator 10 - Batch 4079 | 100 |
| 4080 | 10/21/20 11:53 AM | 10/21/20 2:32 PM | Tabulator 10 - Batch 4080 | 100 |
| 4081 | 10/21/20 12:00 PM | 10/21/20 2:32 PM | Tabulator 10 - Batch 4081 | 101 |
| 4082 | 10/21/20 12:02 PM | 10/21/20 2:32 PM | Tabulator 10 - Batch 4082 | 100 |
| 4083 | 10/21/20 12:05 PM | 10/21/20 2:32 PM | Tabulator 10 - Batch 4083 | 100 |

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| 4084 | 10/21/20 12:08 PM | 10/21/20 2:33 PM | Tabulator 10 - Batch 4084 | 100 |
| 4085 | 10/21/20 12:12 PM | 10/21/20 2:33 PM | Tabulator 10 - Batch 4085 | 100 |
| 4086 | 10/21/20 12:15 PM | 10/21/20 2:33 PM | Tabulator 10 - Batch 4086 | 98 |
| 4087 | 10/21/20 12:50 PM | 10/21/20 2:33 PM | Tabulator 10 - Batch 4087 | 98 |
| 4088 | 10/21/20 12:53 PM | 10/21/20 2:33 PM | Tabulator 10 - Batch 4088 | 95 |
| 4089 | 10/21/20 12:55 PM | 10/21/20 2:33 PM | Tabulator 10 - Batch 4089 | 97 |
| 4090 | 10/21/20 12:58 PM | 10/21/20 2:33 PM | Tabulator 10 - Batch 4090 | 98 |
| 4091 | 10/21/20 1:03 PM | 10/21/20 2:33 PM | Tabulator 10 - Batch 4091 | 95 |
| 4092 | 10/21/20 1:08 PM | 10/21/20 2:33 PM | Tabulator 10 - Batch 4092 | 98 |
| 4093 | 10/21/20 1:10 PM | 10/21/20 2:33 PM | Tabulator 10 - Batch 4093 | 98 |
| 4094 | 10/21/20 1:13 PM | 10/21/20 2:33 PM | Tabulator 10 - Batch 4094 | 95 |
| 4095 | 10/21/20 1:16 PM | 10/21/20 2:33 PM | Tabulator 10 - Batch 4095 | 97 |
| 4096 | 10/21/20 1:19 PM | 10/21/20 2:33 PM | Tabulator 10 - Batch 4096 | 96 |
| 4097 | 10/21/20 1:23 PM | 10/21/20 2:33 PM | Tabulator 10 - Batch 4097 | 95 |
| 4098 | 10/21/20 1:28 PM | 10/21/20 2:33 PM | Tabulator 10 - Batch 4098 | 100 |
| 4099 | 10/21/20 1:29 PM | 10/21/20 2:34 PM | Tabulator 10 - Batch 4099 | 63 |
| 4100 | 10/21/20 1:34 PM | 10/21/20 2:34 PM | Tabulator 10 - Batch 4100 | 100 |
| 3029 | 10/21/20 1:50 PM | 10/21/20 2:34 PM | Tabulator 7 - Batch 3029 | 100 |
| 3030 | 10/21/20 1:53 PM | 10/21/20 2:34 PM | Tabulator 7 - Batch 3030 | 100 |
| 3031 | 10/21/20 1:57 PM | 10/21/20 2:34 PM | Tabulator 7 - Batch 3031 | 100 |
| 3032 | 10/21/20 2:00 PM | 10/21/20 2:34 PM | Tabulator 7 - Batch 3032 | 100 |
| 3033 | 10/21/20 2:05 PM | 10/21/20 2:34 PM | Tabulator 7 - Batch 3033 | 100 |
| 3034 | 10/21/20 2:08 PM | 10/21/20 2:34 PM | Tabulator 7 - Batch 3034 | 100 |
| 3035 | 10/21/20 2:11 PM | 10/21/20 2:34 PM | Tabulator 7 - Batch 3035 | 100 |
| 3036 | 10/21/20 2:14 PM | 10/21/20 2:34 PM | Tabulator 7 - Batch 3036 | 99 |

## REFERENCE B – DATABASES AND TABLES

In order to assist other researchers, who may wish to examine these findings or perform additional analysis, here are the most important databases and tables which were used in this analysis.

**Main Election Database:**
[2020 Mesa County General-2020-09-05-00-10-20]

**Primary Tables:**
*ResultContainer*: (Batch level raw vote data)
*ResultSplitter*: (Vote Data by Polling Location
*ChoiceResult*: (Raw aggregated vote data)
*Choice*: (All Candidates/Choices)
*Contest*: (All contests in Election)
*Tabulator*: (All defined tabulators)

**Stored Procedures:**
*GetContestResults*: Displays current results of any or all contests
*GetContestStatistics*: Displays stats for any or all contests, including undervotes and overvotes

**Adjudication Databases**
[AdjudicableBallotStore_2020_Mesa_County_General_2020-10-21_14:18:51] (before copy)
[AdjudicableBallotStore_2020_Mesa_County_General_2020-10-01_12:18:50] (after copy)

**Primary Tables:**

Batch: Raw batch information
SerializedAdjudicableBallots: Contains one data record for each ballot received.
BallotStatusEvents: Every ballot with adjudication status. New records for same ballot whenever any change occurs in the status of the ballot

## REFERENCE C – LEAD INVESTIGATOR

**Jeffrey O'Donnell – Database and Systems Analyst**

Mr. O'Donnell has over 40 years of experience in Software and Database design. His experience includes work with Rockwell International, Westinghouse Nuclear, Mellon Bank, and the Penn State Applied Research Lab.  He also has extensive experience in analyzing and predicting trends in large data sets. He now runs his own software publishing and consulting firm.