**Attack pattern - Manipulate person(s) (0/1/low/4)**
**Goal:** Force one or more people to do what an attacker wants
**Precondition**: Targets must be susceptible and the attacker must have the resources necessary
**Attack:**

OR 1. Bribe them (20.000/1/low/3)
2. Force them (0/1/low/4)
3. Threaten them (0/1/low/4)

**Postcondition:** The targets will now do what the attacker wants

**Attack pattern - Gain access to partitioning machine (0/1/low/4)**
**Goal:** Gain access to the machine where the full data-set of the election is held and is being partitioned for each election venue
**Precondition:** -
**Attack:**

OR 1. Be responsible for partitioning (0/1/low/1)
2. Manipulate person(s) responsible for partitioning to manipulate the data
<Manipulate person(s)>
3. Manipulate the data without the person(s) responsible noticing (0/1/medium/1)
4. <Digitally force access>
5. Physically force entry and the attacker manipulating the data (0/1/medium/3)

**Postcondition:** Attacker now has access to all data on the partitioning machine

**Attack pattern - Acquire private key used to decrypt data (0/1/low/4)**
**Goal:** To acquire the private key used to decrypt voter data (such as voter-number, CPR number and ballot status)
**Precondition:** Attack must know who generates or where the private key is generated
**Attack:**

OR 1. Be responsible for generating the private key (0/1/medium/1)
2. Manipulate person(s) responsible for generating the private key
<Manipulate person(s)>
3. Steal the private key without being noticed (0/1/medium/1)

**Postcondition:** The attacker now knows how to decrypt data

**Attack pattern - Acquire public key used to encrypt data (0/1/low/4)**
**Goal:** To acquire the public key used to encrypt voter data (such as voter-number, CPR number and ballot status)
**Precondition:**
**Attack:**

OR 1. Gain access to a machine and read the public key from RAM (0/1/high/1)
2. Acquire the USB device with the election-venue data (0/1/low/4)
OR 1. Steal without people transporting it noticing (0/1/low/1)
2. Manipulate person(s) transporting it
<Manipulate person(s)>
3. Be the person responsible for generating the public key (0/1/high/1)

**Postcondition:** Attacker now knows how to encrypt data

**Attack pattern - Digitally force access (0/0/high/2)**
**Goal:** Attacker forces access to the machine through digital means and can execute arbitrary code
**Precondition:** Attacker must have a computer from which he can control the execution and the skills to do so
**Attack:**

OR 1. A machine connected to the DVL-machines is available through the internet (0/0/high/1)
2. A malicious machine is attached to the network (0/0/high/1)

3. A DVL-machine is compromised to begin with (0/0/high/2)

**Postcondition:** Attacker can execute arbitrary code

**Attack pattern - Acquire the database key (0/0/high/2)**
**Goal:** Acquire the database password, to grant access to the database
**Precondition:** The attacker wants to acquire the key used to connect to the local database
**Attack:**

AND 1. <Digitally force access>
2. Acquire database key from secure memory (0/0/high/2)

**Postcondition:** The attacker knows the database key and can access the encrypted data

**Attack pattern - Impersonate other voters (0/1/high/1)**
**Goal:** Attacker impersonates other voters to gain access to more ballots and therefore more votes
**Precondition:** The identification proof must be enough to convince the election officials of the identity
**Attack:**

OR 1. Acquire CPR number and identification-proof (0/1/high/1)
AND 1. Manually request election official to confirm the identity and hand you a ballot (0/1/low/5)
2. Identify CPR and voter-number combinations (0/0/high/1)
OR 1. Acquire voter-cards and CPR number-combination (0/0/high/1)
2. Decrypt database (0/1/high/2)
AND 1. <Acquire private key used to decrypt the data>
2. <Acquire the database-key>
3. Request ballot at station like any other voter (0/1/low/5)

**Postcondition:** Attacker has access to multiple ballots and is able to vote multiple times

**Attack pattern - Access transportation unit and destroy (0/1/low/2)**
**Goal:** To access the unit (e.g. vehicle) which transports the ballots and/or data and destroy it
**Precondition:** The necessary means to gain access to the transportation unit
**Attack:**

AND 1. Locate the transportation unit (0/1/low/2)
2. Gain access to transportation unit (0/1/low/4)
3. Destroy (0/1/low/5)

**Postcondition:** Attacker now has access to the goods inside the transportation unit and can destroy it at will.

**Attack pattern - Enter election venue and destroy (0/1/low/4)**
**Goal:** Enter the election venue and destroy physical objects
**Precondition:** The attacker must know where an election venue is located, and must have the means to destroy the objects
**Attack:**

AND 1. <Gain access to election venue>
2. Destroy objects (0/1/low/5)

**Postcondition:** The objects are destroyed, and must be replaced for the election to proceed

**Attack pattern - Gain access to election venue (0/1/low/4)**
**Goal:** To gain access to the election venue
**Precondition:** Attacker must know the location of the election venue
**Attack:**

OR 1. Physically force access (0/1/low/4)
2. Steal key (0/1/medium/3)
3. Be an insider (0/1/medium/1)
4. Manipulate an insider
<Manipulate person(s)>

**Postcondition:** Attacker has access to the election venue

**Tree 1**

To tamper with the election for personal benefit (0/1/low/4)
OR 1. Manipulate the digital data (0/1/low/4)
OR 1. Before the election (0/1/low/4)
OR 1. During partitioning
<Gain access to partitioning machine>
2. During transportation to election venue (0/1/high/4)
OR 1. Exchange the USB device (0/1/high/4)
AND 1. Physically acquire the device (0/1/low/4)
OR 1. Steal without people transporting it noticing (0/1/low/1)
2. Manipulate people transporting it
<Manipulate person(s)>
2. <Acquire public key used to encrypt the data>
3. Encrypt tampered data-set with public key (0/1/high/5)
4. Write data to own USB device (0/1/low/5)
5. Give new USB device to people transporting it (0/1/low/5)
2. Manipulate the data on the existing USB device (0/1/high/4)
AND 1. Physically acquire the device (0/1/low/4)
OR 1. Steal without people transporting it noticing (0/1/low/1)
2. Manipulate people transporting it
<Manipulate person(s)>
2. Replace or manipulate (0/1/high/4)
OR 1. Manipulate (0/1/high/4)
AND 1. <Acquire private key used to decrypt the data>
2. <Acquire public key used to encrypt the data>
3. Decrypt data-set (0/0/high/5)
4. Manipulate data (0/0/high/5)
5. Encrypt tampered data-set with public key (0/0/high/5)
6. Write data to USB device (0/0/low/5)
2. Replace (0/1/high/4)
AND 1. <Acquire public key used to encrypt the data>
2. Encrypt tampered data-set with public key (0/0/high/5)
3. Write data to USB device (0/0/low/5)
3. On manager-machine before election has started (0/1/high/4)
AND 1. Gain access to the manager-machine (0/1/low/4)
OR 1. Be the election official(s) (0/1/medium/1)
2. Force access (0/1/low/4)
OR 1. Physically force access (0/1/low/3)
2. Digitally force access
<Digitally force access>
3. Force an insider to grant access
<Manipulate person(s)>
2. Replace or manipulate (0/1/high/4)
OR 1. Manipulate (0/1/high/4)
AND 1. <Acquire private key used to decrypt the data>
2. <Acquire public key used to encrypt the data>
3. Decrypt data-set (0/0/high/5)
4. Manipulate data (0/0/high/5)

5. Encrypt tampered data-set with public key (0/0/high/5)
6. Replace data (0/1/low/5)

2. Replace (0/1/high/4)
AND 1. <Acquire public key used to encrypt the data>
2. Encrypt tampered data-set with public key (0/0/high/5)
3. Replace data (0/1/low/5)

2. During the election (0/1/low/4)
OR 1. Manipulate the database on all the machines (0/1/medium/4)
AND 1. Gain access to all machines (0/1/low/4)
OR 1. Physically force access (0/1/low/4)
2. Digitally force access
<Digitally force access>
2. <Acquire public key used to encrypt the data>
3. <Acquire the database key>
4. Manipulate or add records to the database (0/1/medium/5)

2. Gain access to multiple ballots by continuously revoking ballot-received (0/1/low/4)
AND 1. Gain access to the management machine (0/1/low/4)
OR 1. Physically force access (0/1/low/4)
OR 1. Manipulate person with access to the manager-machine
<Manipulate person(s)>
2. Digitally force access
<Digitally force access>
2. Gain access to all signatures and keys, and broadcast revoke-commands to all stations (0/1/high/1)

3. Prevent people from voting by marking them as having received a ballot (0/1/low/1)
AND 1. Identify CPR and voter-number combinations (0/1/low/5)
OR 1. Acquire voter-cards and CPR numbers (0/1/low/5)
2. Decrypt database (0/1/low/4)
AND 1. <Acquire private key used to decrypt the data>
2. <Acquire the database-key>
2. Mark voters (0/1/low/1)
OR 1. Gain access to machine(s) (0/1/low/1)
OR 1. The management machine and manually mark voters as having received ballots (0/1/medium/1)
2. The station and manually request ballots (0/1/low/1)
2. Update database (0/1/high/1)
AND 1. Obtain public key (0/1/high/1)
2. Obtain database-key (0/1/high/1)
3. Update the database (0/1/low/5)

4. Impersonate other voters
<Impersonate other voters>

3. After the election (0/1/high/4)
OR 1. Before being exported (0/1/high/4)
AND 1. Gain access to the manager-machine (0/1/low/4)
OR 1. Be the election official(s) (0/1/medium/1)
2. Force access (0/1/low/4)
OR 1. Physically force access (0/1/low/4)
2. Digitally force access
<Digitally force access>
3. Force an insider to grant access
<Manipulate person(s)>

2. Replace or manipulate (0/1/high/4)
OR 1. Manipulate (0/1/high/4)
AND 1. <Acquire private key used to decrypt the data>
2. <Acquire public key used to encrypt the data>
3. Decrypt data-set (0/0/high/5)
4. Manipulate data (0/0/high/5)
5. Encrypt tampered data-set with public key (0/0/high/5)
6. Replace data (0/1/high/5)
2. Replace (0/1/high/4)
AND 1. <Acquire public key used to encrypt the data>
2. Encrypt tampered data-set with public key (0/0/high/5)
3. Replace data (0/1/high/5)
2. During transportation (0/1/high/4)
OR 1. Exchange the USB device (0/1/high/4)
AND 1. Physically acquire the device (0/1/low/4)
OR 1. Steal without people transporting it noticing (0/1/low/1)
2. Manipulate people transporting it
<Manipulate person(s)>
2. <Acquire public key used to encrypt the data>
3. Encrypt tampered data-set with public key (0/0/high/5)
4. Write data to own USB device (0/1/high/5)
5. Give new USB device to people transporting it (0/1/low/5)
2. Manipulate the data on the existing USB device (0/1/high/4)
AND 1. Physically acquire the device (0/1/low/4)
OR 1. Steal without people transporting it noticing (0/1/low/1)
2. Manipulate people transporting it
<Manipulate person(s)>
2. Replace or manipulate (0/1/high/4)
OR 1. Manipulate (0/1/high/4)
AND 1. <Acquire private key used to decrypt the data>
2. <Acquire public key used to encrypt the data>
3. Decrypt data-set (0/0/high/5)
4. Manipulate data (0/0/high/5)
5. Encrypt tampered data-set with public key (0/0/high/5)
6. Write data to USB device (0/1/medium/5)
2. Replace (0/1/high/4)
AND 1. <Acquire public key used to encrypt the data>
2. Encrypt tampered data-set with public key (0/0/high/5)
3. Write data to USB device (0/1/medium/5)
3. At the tallying location (0/1/low/4)
OR 1. Be responsible for tallying (0/1/medium/1)
2. Manipulate person(s) responsible for tallying to manipulate the data
<Manipulate person(s)>
3. Manipulate the data without the person(s) responsible noticing (0/1/low/4)
4. <Digitally force access>
5. Physically force entry and the attacker manipulating the data (0/1/low/3)
2. Vote several times without manipulating the digital data (0/1/low/4)
AND 1. Physically gain access to ballots (0/1/low/4)

2. Force election officials to accept them
<Manipulate person(s)>

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**Tree 2**

To destroy the election (0/1/low/4)
OR 1. Physically destroy the storage units when being transported (0/1/low/2)
OR 1. Before the election
<Access transportation unit and destroy>
2. After the election
<Access transportation unit and destroy>
2. Destroy the election stations (0/1/low/4)
OR 1. Before the election
<Enter election venue and destroy>
2. During the election
<Enter election venue and destroy>
3. Destroying ballots (0/1/low/4)
OR 1. Before election (0/1/low/4)
OR 1. When being transported to election venue
<Access transportation unit and destroy>
2. At the election venue (0/1/low/4)
AND 1. <Gain access to election venue>
2. Destroy ballots (0/1/low/5)
2. During the election
<Enter election venue and destroy>
3. After the election (0/1/low/4)
OR 1. At the election venue
<Enter election venue and destroy>
2. During transportation
<Access transportation unit and destroy>
3. At tallying place (0/1/low/3)
AND 1. Locate tallying place (0/1/low/3)
2. Gain access to tallying place (0/1/low/4)
3. Destroy (0/1/low/5)
4. Prevent people from voting at the election venue (0/1/low/2)
OR 1. Prevent them from receiving voter cards (0/1/low/2)
2. Physically prevent them from entering election venue (0/1/low/2)
5. Deleting data (0/1/low/4)
OR 1. Before the election (0/1/low/4)
OR 1. During partitioning
<Gain access to partitioning machine>
2. During transportation to election venue (0/1/medium/4)
OR 1. Delete data on the USB device (0/1/medium/4)
AND 1. Physically acquire the device (0/1/low/4)
OR 1. Steal without people transporting it noticing (0/1/low/1)
2. Manipulate people transporting it
<Manipulate person(s)>
2. Delete the data (0/1/medium/5)
3. (Optional) Give the USB device to people transporting it (0/1/low/5)
3. On manager-machine before election has started (0/1/medium/4)

AND 1. Gain access to the manager-machine (0/1/low/4)
OR 1. Be the election official(s) (0/1/medium/1)
2. Force access (0/1/low/4)
OR 1. Physically force access (0/1/low/4)
2. Digitally force access
<Digitally force access>
3. Force an insider to grant access
<Manipulate person(s)>
2. Delete the data (0/1/medium/5)
2. During the election (0/1/high/2)
OR 1. Delete the database on all the machines (0/1/high/2)
AND 1. Gain access to all machines (0/1/low/4)
OR 1. Physically force access (0/1/low/4)
2. Digitally force access
<Digitally force access>
2. Delete the database (0/1/high/2)
3. After the election (0/1/low/4)
OR 1. Before being exported (0/1/high/2)
AND 1. Gain access to the manager-machine (0/1/low/4)
OR 1. Be the election official(s) (0/1/medium/1)
2. Force access (0/1/low/4)
OR 1. Physically force access (0/1/low/4)
2. Digitally force access
<Digitally force access>
3. Force an insider to grant access
<Manipulate person(s)>
2. Delete the database (0/1/high/2)
2. During transportation (0/1/high/4)
OR 1. Delete data on the USB device (0/1/high/4)
AND 1. Physically acquire the device (0/1/low/4)
OR 1. Steal without people transporting it noticing (0/1/low/1)
2. Manipulate people transporting it
<Manipulate person(s)>
2. Delete the data (0/1/high/5)
3. (Optional) Give the USB device to people transporting it (0/1/low/5)
3. At the tallying location (0/1/low/4)
OR 1. Be responsible for tallying (0/1/low/1)
2. Manipulate person(s) responsible for tallying to delete the data
<Manipulate person(s)>
3. Delete the data without the person(s) responsible noticing (0/1/high/1)
4. <Digitally force access>
5. Physically force entry and the attacker deleting the data (0/1/low/4)
6. Corrupting data (0/1/low/4)
OR 1. Before the election (0/1/low/4)
OR 1. During partitioning
<Gain access to partitioning machine>
2. During transportation to election venue (0/1/low/4)
OR 1. Corrupt the USB device (0/1/low/4)
AND 1. Physically acquire the device (0/1/low/4)
OR 1. Steal without people transporting it noticing (0/1/low/1)
2. Manipulate people transporting it
<Manipulate person(s)>
2. Corrupt the data (0/1/high/5)
3. (Optional) Give the USB device to people transporting it

(0/1/low/5)
3. On manager-machine before election has started (0/1/high/4)
AND 1. Gain access to the manager-machine (0/1/low/4)
OR 1. Be the election official(s) (0/1/medium/1)
2. Force access (0/1/low/4)
OR 1. Physically force access (0/1/low/4)
2. Digitally force access
<Digitally force access>
3. Force an insider to grant access
<Manipulate person(s)>
2. Corrupt the data (0/1/high/5)
2. During the election (0/1/high/4)
OR 1. Corrupt the database on all the machines (0/1/high/4)
AND 1. Gain access to all machines (0/1/low/4)
OR 1. Physically force access (0/1/low/4)
2. Digitally force access
<Digitally force access>
2. Corrupt the data (0/1/high/5)
3. After the election (0/1/low/4)
OR 1. Before being exported (0/1/high/4)
AND 1. Gain access to the manager-machine (0/1/low/4)
OR 1. Be the election official(s) (0/1/low/1)
2. Force access (0/1/low/4)
OR 1. Physically force access (0/1/low/4)
2. Digitally force access
<Digitally force access>
3. Force an insider to grant access
<Manipulate person(s)>
2. Corrupt the data (0/1/high/5)
2. During transportation (0/1/low/4)
OR 1. Corrupt the USB device (0/1/low/4)
AND 1. Physically acquire the device
OR 1. Steal without people transporting it noticing (0/1/low/1)
2. Manipulate people transporting it
<Manipulate person(s)>
2. Corrupt the data (0/1/high/5)
3. (Optional) Give the USB device to people transporting it
(0/1/low/5)
3. At the tallying location (0/1/low/4)
OR 1. Be responsible for tallying (0/1/low/1)
2. Manipulate person(s) responsible for tallying to corrupt the data
<Manipulate person(s)>
3. Corrupt the data without the person(s) responsible noticing (0/1/high/
1)
4. <Digitally force access>
5. Physically force entry and the attacker corrupting the data (0/1/low/4)

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**Tree 3**

To gain knowledge about a protected part of the election (0/1/low/4)
OR 1. Get access to the digital data before it's partitioned
<Gain access to partitioning machine>
2. Gain access to the partitioned data while it's being transported to the election venue (0/1/high/
4)
OR 1. Access the USB device (0/1/high/4)

AND 1. Physically acquire the device (0/1/low/4)
OR 1. Steal without people transporting it noticing (0/1/low/1)
2. Manipulate people transporting it
<Manipulate person(s)>
2. <Acquire private key used to decrypt the data>
3. Decrypt and read data (0/1/high/5)

3. Physically spy on the voters during the election (0/1/low/1)
OR 1. Place cameras in the election booths (20.000/1/high/1)
AND 1. Locate the election venue and booths (0/1/low/4)
2. Acquire cameras (20.000/1/low/5)
3. Gain access to the election venue
<Gain access to the election venue>
4. Install the cameras in the election booths without anyone noticing (0/1/high/1)
2. Physically be in the election booth to spy (0/1/low/1)

4. Gain access to the digital data during the election (0/1/low/4)
OR 1. Access a database on a machine (0/1/low/4)
AND 1. Gain access to the machine (0/1/low/4)
OR 1. Physically force access (0/1/low/4)
2. Digitally force access
<Digitally force access>
2. <Acquire private key used to decrypt the data>
3. <Acquire the database key>
4. Decrypt and read the data (0/1/high/5)

5. Gain access to the digital data after the election has ended (0/1/low/4)
OR 1. At election venue (0/1/low/4)
*Same as gain access to the digital data during the election*
2. Intercept the transportation of the exported data (0/1/low/4)
OR 1. Access the USB device (0/1/low/4)
AND 1. Physically acquire the device (0/1/low/4)
OR 1. Steal without people transporting it noticing (0/1/low/1)
2. Manipulate people transporting it
<Manipulate person(s)>
2. <Acquire private key used to decrypt the data>
3. Decrypt and read data (0/1/high/5)
3. At the tallying place (0/1/low/4)
OR 1. Be responsible for tallying (0/1/low/1)
2. Manipulate person(s) responsible for tallying to manipulate the data
<Manipulate person(s)>
3. Manipulate the data without the person(s) responsible noticing
4. <Digitally force access>
5. Physically force entry and the attacker manipulating the data (0/1/low/4)