# **Annex B — Part 0: Schema & Conventions**

**Scope.** Defines the common rules, identifiers, and shapes used by all test fixtures in Annex B (Parts 1–7). Aligns with Docs 1–7.

## **1) Identifier patterns (canonical)**

* **DivisionRegistry ID:** REG:<name>:<version>
* **Unit ID:** U:<REG\_ID>:<path> (tree path; root has no parent)
* **Option ID:** OPT:<slug>
* **BallotTally ID:** TLY:<name>:v<digit>
* **ParameterSet ID:** PS:<name>:v<digit>
* **Result ID:** RES:<hash>
* **RunRecord ID:** RUN:<timestamp>-<hash> (format per Doc 1B)
* **FrontierMap ID:** FR:<hash>
* **AutonomyPackage ID:** AP:<name>:v<digit>

**Ordering rules (deterministic):**

* Units sorted lexicographically by **Unit ID**.
* Options sorted by **Option.order\_index** (ascending), then by **Option ID**.
* All lists in fixtures should already respect these orders.

## **2) Core conventions**

* **Percent parameters** are integers 0..100. Internals use exact integer/rational math.
* **Approval gate denominator (fixed):** for approval ballots, **support % = approvals\_for\_change / valid ballots**.
* **Rounding (internal):** *round half to even* only at defined comparison points (Docs 4A/4C).
* **Rounding (presentation):** one decimal place in expected values shown in Annex B and reports (Doc 7).
* **Determinism:** same inputs + same seed ⇒ byte-identical **Result** and **RunRecord**.
* **RNG use:** only if tie\_policy = random; algorithm is the seeded stream RNG defined in Doc 3A; seed recorded as **VM-VAR-052**.
* **Offline:** fixtures assume no network access (Doc 3A).

## **3) Validation rules expected of engines (applied to all parts)**

* **Hierarchy:** Units form a tree within one **DivisionRegistry**; exactly one root; no cycles.
* **Magnitude:** Unit.magnitude ≥ 1; if VM-VAR-010 = winner\_take\_all, every involved Unit must have magnitude = 1.
* **Tally sanity (per Unit):** Σ(valid option tallies) + invalid\_or\_blank ≤ ballots\_cast.
* **Eligible roll:** if VM-VAR-020 > 0 or VM-VAR-021 > 0, each aggregated Unit must have eligible\_roll ≥ ballots\_cast.
* **Population weighting:** if VM-VAR-030 = population\_baseline, each aggregated Unit must have population\_baseline > 0 and a population\_baseline\_year.
* **Frontier bands:** if VM-VAR-040 ∈ {sliding\_scale, autonomy\_ladder}, bands (VM-VAR-042) are ordered, non-overlapping, and respect the intended ranges.
* **Contiguity types:** Adjacency.type ∈ {land, bridge, water}; VM-VAR-047 is a subset; VM-VAR-048 ∈ {none, ferry\_allowed, corridor\_required}.
* **Double-majority w/o frontier:** if VM-VAR-024 = on and VM-VAR-040 = none, then VM-VAR-026 ∈ {by\_list, by\_tag} and VM-VAR-027 resolves to a non-empty family.

## **4) Fixture shapes (what each part will contain)**

### **4.1 DivisionRegistry**

* id, provenance{source, published\_date}
* **Units[]:** id, name, level, optional parent, magnitude, eligible\_roll, optional population\_baseline & population\_baseline\_year, optional protected\_area
* **Adjacency[] (optional):** unit\_id\_a, unit\_id\_b, type (land|bridge|water), optional notes

### **4.2 Options**

* **Options[]:** id, display\_name, order\_index (unique), is\_status\_quo (bool)

### **4.3 Ballot tallies (per ballot type)**

* **Approval:** per Unit: ballots\_cast, invalid\_or\_blank, approvals{Option→count}
* **Plurality:** per Unit: ballots\_cast, invalid\_or\_blank, votes{Option→count}
* **Score:** per Unit: ballots\_cast, invalid\_or\_blank, score\_sum{Option→sum}, ballots\_counted; plus scale (VM-VAR-002..003) and normalization (VM-VAR-004)
* **Ranked IRV (executive or unit):** rounds[{ranking[], count}]; exhaustion policy is reduce\_continuing\_denominator (VM-VAR-006)
* **Ranked Condorcet:** ballots[{ranking[], count}]; completion rule per VM-VAR-005

### **4.4 ParameterSet**

* id; vars{VM-VAR-### → value} (values per Docs 2A/2B/2C)

### **4.5 Expected / Acceptance blocks**

* **Expected (typical):**
  + gate outcomes (quorum/majority/double\_majority/symmetry)
  + national support %, seat allocations by option, executive winner and IRV summary, frontier statuses per Unit
  + final **label** (Decisive|Marginal|Invalid) and reason strings where relevant
* **Acceptance (determinism/perf parts):** flags for identical hashes across runs/OS and performance-within-profile.

## **5) Defaults used in small canonical tests (unless a test overrides)**

* VM-VAR-001 ballot\_type = approval
* VM-VAR-010 allocation\_method = proportional\_favor\_small
* VM-VAR-012 pr\_entry\_threshold\_pct = 0
* VM-VAR-020 quorum\_global\_pct = 50
* VM-VAR-022 national\_majority\_pct = 55
* VM-VAR-023 regional\_majority\_pct = 55
* VM-VAR-024 double\_majority\_enabled = on
* VM-VAR-025 symmetry\_enabled = on
* VM-VAR-030 weighting\_method = population\_baseline
* VM-VAR-031 aggregate\_level = country
* VM-VAR-040 frontier\_mode = none
* VM-VAR-050 tie\_policy = status\_quo
* Report precision: one decimal (Doc 7A/7B)

## **6) Notes for implementers**

* Counts in fixtures are authoritative; percentages are derived—do not round twice.
* Use stable ordering (Units by ID; Options by order\_index) before hashing/serialization to meet Doc 6C determinism tests.
* expected\_canonical\_hash fields are to be filled after the **first certified run** using the canonical serialization rules defined in Doc 3B (sorted keys, LF line endings, UTC timestamps).

**Next:** Annex B — Part 1 (Core Allocation Fixtures: VM-TST-001/002/003).

# **Annex B — Part 1: Core Allocation Fixtures (Doc 6A)**

**Covers tests:** VM-TST-001, 002, 003.  
 **Purpose:** Lock baseline allocation behavior for PR (Sainte-Laguë), WTA, and method convergence on a specific split.  
 **Conventions:** Follow Part 0 (IDs, ordering, rounding, validation).

## **VM-TST-001 — Happy PR baseline (Sainte-Laguë)**

**Purpose.** Confirm Sainte-Laguë with m=10 yields seats **A/B/C/D = 1/2/3/4**.

**Registry.** Single national unit.

* REG:CoreAlloc001:1
* Unit: U:REG:CoreAlloc001:1:NAT (level Country, magnitude=10, eligible\_roll=100, population\_baseline=1, year 2025)

**Options (order fixed).**

* OPT:A (order\_index 1), OPT:B (2), OPT:C (3), OPT:D (4)

**BallotTally (approval; one approval per ballot to satisfy tally-sanity).**

* TLY:TST001:v1
* Unit NAT: ballots\_cast=100, invalid\_or\_blank=0, approvals {A:10, B:20, C:30, D:40}

**ParameterSet & expected.**

* PS:TST001:SainteLague:v1  
   VM-VAR-001=approval; VM-VAR-010=proportional\_favor\_small; VM-VAR-011=on; VM-VAR-012=0; VM-VAR-040=none
* **Expected seats:** {A:1, B:2, C:3, D:4}; **Label:** Decisive.

**Canonical fixture (machine-readable).**

{

"id": "VM-TST-001",

"registry": {

"id": "REG:CoreAlloc001:1",

"provenance": {"source": "AnnexB", "published\_date": "2025-08-11"},

"units": [

{"id": "U:REG:CoreAlloc001:1:NAT","name":"Country","level":"Country","magnitude":10,"eligible\_roll":100,"population\_baseline":1,"population\_baseline\_year":2025}

]

},

"options": [

{"id":"OPT:A","display\_name":"A","order\_index":1,"is\_status\_quo":false},

{"id":"OPT:B","display\_name":"B","order\_index":2,"is\_status\_quo":false},

{"id":"OPT:C","display\_name":"C","order\_index":3,"is\_status\_quo":false},

{"id":"OPT:D","display\_name":"D","order\_index":4,"is\_status\_quo":false}

],

"ballot\_tally": {

"id":"TLY:TST001:v1",

"ballot\_type":"approval",

"units":{

"U:REG:CoreAlloc001:1:NAT":{"ballots\_cast":100,"invalid\_or\_blank":0,"approvals":{"OPT:A":10,"OPT:B":20,"OPT:C":30,"OPT:D":40}}

}

},

"parameter\_sets": [

{

"id":"PS:TST001:SainteLague:v1",

"vars":{"VM-VAR-001":"approval","VM-VAR-010":"proportional\_favor\_small","VM-VAR-011":"on","VM-VAR-012":0,"VM-VAR-040":"none"},

"expected":{"total\_seats\_by\_party":{"OPT:A":1,"OPT:B":2,"OPT:C":3,"OPT:D":4},"label":"Decisive"}

}

],

"expected\_canonical\_hash": null

}

## **VM-TST-002 — WTA wipe-out**

**Purpose.** Winner-take-all with m=1 gives full power to the plurality winner (**D**).

**Registry.** Single national unit.

* REG:CoreAlloc002:1
* Unit: U:REG:CoreAlloc002:1:NAT (magnitude=1, eligible\_roll=100, population\_baseline=1)

**Options (order fixed).** OPT:A..OPT:D as above.

**BallotTally (plurality).**

* TLY:TST002:v1
* NAT: ballots\_cast=100, invalid\_or\_blank=0, votes {A:10, B:20, C:30, D:40}

**ParameterSet & expected.**

* PS:TST002:WTA:v1  
   VM-VAR-001=plurality; VM-VAR-010=winner\_take\_all; VM-VAR-011=on; VM-VAR-040=none
* **Expected power:** {D:100} (others 0); **Label:** Decisive.

**Canonical fixture.**

{

"id": "VM-TST-002",

"registry": {

"id": "REG:CoreAlloc002:1",

"provenance": {"source": "AnnexB","published\_date":"2025-08-11"},

"units": [

{"id":"U:REG:CoreAlloc002:1:NAT","name":"Country","level":"Country","magnitude":1,"eligible\_roll":100,"population\_baseline":1,"population\_baseline\_year":2025}

]

},

"options": [

{"id":"OPT:A","display\_name":"A","order\_index":1,"is\_status\_quo":false},

{"id":"OPT:B","display\_name":"B","order\_index":2,"is\_status\_quo":false},

{"id":"OPT:C","display\_name":"C","order\_index":3,"is\_status\_quo":false},

{"id":"OPT:D","display\_name":"D","order\_index":4,"is\_status\_quo":false}

],

"ballot\_tally": {

"id":"TLY:TST002:v1",

"ballot\_type":"plurality",

"units":{

"U:REG:CoreAlloc002:1:NAT":{"ballots\_cast":100,"invalid\_or\_blank":0,"votes":{"OPT:A":10,"OPT:B":20,"OPT:C":30,"OPT:D":40}}

}

},

"parameter\_sets": [

{

"id":"PS:TST002:WTA:v1",

"vars":{"VM-VAR-001":"plurality","VM-VAR-010":"winner\_take\_all","VM-VAR-011":"on","VM-VAR-040":"none"},

"expected":{"local\_seats\_by\_party":{"OPT:D":1},"total\_seats\_by\_party":{"OPT:D":1},"label":"Decisive"}

}

],

"expected\_canonical\_hash": null

}

## **VM-TST-003 — Largest Remainder vs Highest-Average (convergent case)**

**Purpose.** With **A/B/C = 34/33/33** and m=7, LR, Sainte-Laguë, and D’Hondt all yield **A/B/C = 3/2/2**.

**Registry.**

* REG:CoreAlloc003:1
* Unit: U:REG:CoreAlloc003:1:NAT (magnitude=7, eligible\_roll=100, population\_baseline=1)

**Options (order fixed).** OPT:A, OPT:B, OPT:C.

**BallotTally (approval; one approval per ballot).**

* TLY:TST003:v1
* NAT: ballots\_cast=100, invalid\_or\_blank=0, approvals {A:34, B:33, C:33}

**ParameterSets & expected.**

* PS:TST003:LR:v1 → VM-VAR-010=largest\_remainder → seats {A:3,B:2,C:2}
* PS:TST003:SainteLague:v1 → VM-VAR-010=proportional\_favor\_small → {3,2,2}
* PS:TST003:DHondt:v1 → VM-VAR-010=proportional\_favor\_big → {3,2,2}
* **Label:** Decisive in all three.

**Canonical fixture.**

{

"id": "VM-TST-003",

"registry": {

"id": "REG:CoreAlloc003:1",

"provenance": {"source":"AnnexB","published\_date":"2025-08-11"},

"units": [

{"id":"U:REG:CoreAlloc003:1:NAT","name":"Country","level":"Country","magnitude":7,"eligible\_roll":100,"population\_baseline":1,"population\_baseline\_year":2025}

]

},

"options": [

{"id":"OPT:A","display\_name":"A","order\_index":1,"is\_status\_quo":false},

{"id":"OPT:B","display\_name":"B","order\_index":2,"is\_status\_quo":false},

{"id":"OPT:C","display\_name":"C","order\_index":3,"is\_status\_quo":false}

],

"ballot\_tally": {

"id":"TLY:TST003:v1",

"ballot\_type":"approval",

"units":{

"U:REG:CoreAlloc003:1:NAT":{"ballots\_cast":100,"invalid\_or\_blank":0,"approvals":{"OPT:A":34,"OPT:B":33,"OPT:C":33}}

}

},

"parameter\_sets": [

{

"id":"PS:TST003:LR:v1",

"vars":{"VM-VAR-001":"approval","VM-VAR-010":"largest\_remainder","VM-VAR-011":"on","VM-VAR-012":0},

"expected":{"total\_seats\_by\_party":{"OPT:A":3,"OPT:B":2,"OPT:C":2},"label":"Decisive"}

},

{

"id":"PS:TST003:SainteLague:v1",

"vars":{"VM-VAR-001":"approval","VM-VAR-010":"proportional\_favor\_small","VM-VAR-011":"on","VM-VAR-012":0},

"expected":{"total\_seats\_by\_party":{"OPT:A":3,"OPT:B":2,"OPT:C":2},"label":"Decisive"}

},

{

"id":"PS:TST003:DHondt:v1",

"vars":{"VM-VAR-001":"approval","VM-VAR-010":"proportional\_favor\_big","VM-VAR-011":"on","VM-VAR-012":0},

"expected":{"total\_seats\_by\_party":{"OPT:A":3,"OPT:B":2,"OPT:C":2},"label":"Decisive"}

}

],

"expected\_canonical\_hash": null

}

**Notes (all three tests).**

* Deterministic order **A > B > C > D** via Option.order\_index.
* No frontier; no gate failures are expected in these fixtures.
* Approval tallies are constructed so Σ approvals = ballots\_cast to satisfy the simple tally-sanity rule (one approval per ballot in these tests).

**Next:** Annex B — Part 2 (Gates Fixtures: VM-TST-004/005/006/007).

# **Annex B — Part 2: Gates Fixtures (Doc 6B — Quorum/Majority/Double/Symmetry)**

**Covers tests:** VM-TST-004, 005, 006, 007.  
 **Purpose:** Exercise legitimacy gates using the fixed denominators and rules:

* Approval gate uses **approval rate = approvals\_for\_change / valid ballots**.
* Quorum uses **eligible\_roll**.
* Double-majority uses national + **affected-region family**.
* Symmetry applies identical thresholds in mirrored scenarios.  
   **Conventions:** Follow Part 0 (IDs, ordering, rounding, validation).

## **VM-TST-004 — Exact supermajority edge (≥ rule)**

**Purpose.** Show that **55.0%** meets a **55%** supermajority threshold.

**Registry.** One national unit.

* REG:Gates004:1
* Unit: U:REG:Gates004:1:NAT (Country, magnitude=1, eligible\_roll=100, population\_baseline=1, year 2025)

**Options.**

* OPT:Change (order\_index 1, is\_status\_quo=false)
* OPT:StatusQuo (order\_index 2, is\_status\_quo=true)

**BallotTally (approval).**

* TLY:TST004:v1
* NAT: ballots\_cast=100, invalid\_or\_blank=0, approvals {Change:55, StatusQuo:45}

**ParameterSet & expected.**

* PS:TST004:Edge55:v1  
   VM-VAR-001=approval; VM-VAR-020=0; VM-VAR-022=55; VM-VAR-024=on; VM-VAR-040=none
* **Expected:** Majority **Pass**; **Label:** Decisive.

**Canonical fixture.**

{

"id": "VM-TST-004",

"registry": {

"id": "REG:Gates004:1",

"provenance": {"source":"AnnexB","published\_date":"2025-08-11"},

"units": [

{"id":"U:REG:Gates004:1:NAT","name":"Country","level":"Country","magnitude":1,"eligible\_roll":100,"population\_baseline":1,"population\_baseline\_year":2025}

]

},

"options": [

{"id":"OPT:Change","display\_name":"Change","order\_index":1,"is\_status\_quo":false},

{"id":"OPT:StatusQuo","display\_name":"Status Quo","order\_index":2,"is\_status\_quo":true}

],

"ballot\_tally": {

"id":"TLY:TST004:v1",

"ballot\_type":"approval",

"units":{

"U:REG:Gates004:1:NAT":{"ballots\_cast":100,"invalid\_or\_blank":0,"approvals":{"OPT:Change":55,"OPT:StatusQuo":45}}

}

},

"parameter\_sets": [

{

"id":"PS:TST004:Edge55:v1",

"vars":{"VM-VAR-001":"approval","VM-VAR-020":0,"VM-VAR-022":55,"VM-VAR-024":"on","VM-VAR-040":"none"},

"expected":{"gates":{"majority":"Pass"},"label":"Decisive"}

}

],

"expected\_canonical\_hash": null

}

## **VM-TST-005 — Quorum failure**

**Purpose.** Turnout **below 50%** invalidates the run even if support ≥ threshold.

**Registry.** One national unit.

* REG:Gates005:1
* Unit: U:REG:Gates005:1:NAT (magnitude=1, eligible\_roll=1000, population\_baseline=1, year 2025)

**Options.** OPT:Change (1), OPT:StatusQuo (2).

**BallotTally (approval).**

* TLY:TST005:v1
* NAT: ballots\_cast=480, invalid\_or\_blank=0, approvals {Change:288, StatusQuo:192} → approval rate for Change = **60.0%**.

**ParameterSet & expected.**

* PS:TST005:QuorumFail:v1  
   VM-VAR-001=approval; VM-VAR-020=50; VM-VAR-022=55; VM-VAR-024=on; VM-VAR-040=none
* **Expected:** Quorum **Fail** (turnout 48.0% vs 50%); **Label:** Invalid (reason Quorum failed).

**Canonical fixture.**

{

"id": "VM-TST-005",

"registry": {

"id": "REG:Gates005:1",

"provenance": {"source":"AnnexB","published\_date":"2025-08-11"},

"units": [

{"id":"U:REG:Gates005:1:NAT","name":"Country","level":"Country","magnitude":1,"eligible\_roll":1000,"population\_baseline":1,"population\_baseline\_year":2025}

]

},

"options": [

{"id":"OPT:Change","display\_name":"Change","order\_index":1,"is\_status\_quo":false},

{"id":"OPT:StatusQuo","display\_name":"Status Quo","order\_index":2,"is\_status\_quo":true}

],

"ballot\_tally": {

"id":"TLY:TST005:v1",

"ballot\_type":"approval",

"units":{

"U:REG:Gates005:1:NAT":{"ballots\_cast":480,"invalid\_or\_blank":0,"approvals":{"OPT:Change":288,"OPT:StatusQuo":192}}

}

},

"parameter\_sets": [

{

"id":"PS:TST005:QuorumFail:v1",

"vars":{"VM-VAR-001":"approval","VM-VAR-020":50,"VM-VAR-022":55,"VM-VAR-024":"on","VM-VAR-040":"none"},

"expected":{"gates":{"quorum":"Fail","majority":"Pass"},"label":"Invalid","invalid\_reason":"Quorum failed"}

}

],

"expected\_canonical\_hash": null

}

## **VM-TST-006 — Double-majority failure (affected family by list)**

**Purpose.** National **passes** (57%), but **affected regions** minimum is **53%** → **Fail**.

Note: To satisfy validation (“double-majority with frontier=none must use by\_list/by\_tag”), we define the family **by\_list**.

**Registry.** Three regions.

* REG:Gates006:1
* Units (level Region; equal baselines/rolls):  
  + U:REG:Gates006:1:R1 (eligible\_roll=100, pop=1)
  + U:REG:Gates006:1:R2 (eligible\_roll=100, pop=1)
  + U:REG:Gates006:1:R3 (eligible\_roll=100, pop=1)

**Options.** OPT:Change (1), OPT:StatusQuo (2).

**BallotTally (approval).**

* TLY:TST006:v1
* R1 approvals {Change:60, SQ:40}
* R2 approvals {Change:58, SQ:42}
* R3 approvals {Change:53, SQ:47}  
   → National approval rate = (60+58+53)/300 = **57.0%**.

**ParameterSet & expected.**

* PS:TST006:DMFail:v1  
   VM-VAR-001=approval; VM-VAR-020=0; VM-VAR-022=55; VM-VAR-023=55; VM-VAR-024=on; VM-VAR-026=by\_list; VM-VAR-027=["U:REG:Gates006:1:R1","U:REG:Gates006:1:R2","U:REG:Gates006:1:R3"]; VM-VAR-040=none
* **Expected:** National **Pass**, Double-majority **Fail** (lowest region 53%); **Label:** Invalid.

**Canonical fixture.**

{

"id": "VM-TST-006",

"registry": {

"id": "REG:Gates006:1",

"provenance": {"source":"AnnexB","published\_date":"2025-08-11"},

"units": [

{"id":"U:REG:Gates006:1:R1","name":"R1","level":"Region","magnitude":1,"eligible\_roll":100,"population\_baseline":1,"population\_baseline\_year":2025},

{"id":"U:REG:Gates006:1:R2","name":"R2","level":"Region","magnitude":1,"eligible\_roll":100,"population\_baseline":1,"population\_baseline\_year":2025},

{"id":"U:REG:Gates006:1:R3","name":"R3","level":"Region","magnitude":1,"eligible\_roll":100,"population\_baseline":1,"population\_baseline\_year":2025}

]

},

"options": [

{"id":"OPT:Change","display\_name":"Change","order\_index":1,"is\_status\_quo":false},

{"id":"OPT:StatusQuo","display\_name":"Status Quo","order\_index":2,"is\_status\_quo":true}

],

"ballot\_tally": {

"id":"TLY:TST006:v1",

"ballot\_type":"approval",

"units":{

"U:REG:Gates006:1:R1":{"ballots\_cast":100,"invalid\_or\_blank":0,"approvals":{"OPT:Change":60,"OPT:StatusQuo":40}},

"U:REG:Gates006:1:R2":{"ballots\_cast":100,"invalid\_or\_blank":0,"approvals":{"OPT:Change":58,"OPT:StatusQuo":42}},

"U:REG:Gates006:1:R3":{"ballots\_cast":100,"invalid\_or\_blank":0,"approvals":{"OPT:Change":53,"OPT:StatusQuo":47}}

}

},

"parameter\_sets": [

{

"id":"PS:TST006:DMFail:v1",

"vars":{"VM-VAR-001":"approval","VM-VAR-020":0,"VM-VAR-022":55,"VM-VAR-023":55,"VM-VAR-024":"on","VM-VAR-026":"by\_list","VM-VAR-027":["U:REG:Gates006:1:R1","U:REG:Gates006:1:R2","U:REG:Gates006:1:R3"],"VM-VAR-040":"none"},

"expected":{"gates":{"majority":"Pass","double\_majority":"Fail"},"label":"Invalid","invalid\_reason":"Regional threshold not met (min 53.0%)"}

}

],

"expected\_canonical\_hash": null

}

## **VM-TST-007 — Symmetry respected (mirrored scenarios)**

**Purpose.** The same thresholds/denominators produce matching Pass results in **A→B** and **B→A** setups with **56%** support.

Implementation note: encoded as **two small subtests** (A and B) to keep Option metadata (is\_status\_quo) consistent without redefining shapes. Both together satisfy Doc 6B’s VM-TST-007.

### **VM-TST-007-A — A→B (Change = B)**

**Registry.** REG:Symm007:1, Unit ...:NAT (eligible\_roll=100, baseline=1).

**Options.**

* OPT:A (order\_index 1, is\_status\_quo=true)
* OPT:B (order\_index 2, is\_status\_quo=false) ← treated as **Change**

**BallotTally.**

* TLY:TST007A:v1 — approvals {B:56, A:44} (valid=100)

**ParameterSet & expected.**

* PS:TST007A:v1 — VM-VAR-001=approval; VM-VAR-022=55; VM-VAR-040=none
* **Expected:** Majority **Pass**; **Label:** Decisive.

**Canonical fixture.**

{

"id": "VM-TST-007-A",

"registry": {

"id": "REG:Symm007:1",

"provenance": {"source":"AnnexB","published\_date":"2025-08-11"},

"units": [

{"id":"U:REG:Symm007:1:NAT","name":"Country","level":"Country","magnitude":1,"eligible\_roll":100,"population\_baseline":1,"population\_baseline\_year":2025}

]

},

"options": [

{"id":"OPT:A","display\_name":"A","order\_index":1,"is\_status\_quo":true},

{"id":"OPT:B","display\_name":"B","order\_index":2,"is\_status\_quo":false}

],

"ballot\_tally": {

"id":"TLY:TST007A:v1",

"ballot\_type":"approval",

"units":{

"U:REG:Symm007:1:NAT":{"ballots\_cast":100,"invalid\_or\_blank":0,"approvals":{"OPT:B":56,"OPT:A":44}}

}

},

"parameter\_sets": [

{

"id":"PS:TST007A:v1",

"vars":{"VM-VAR-001":"approval","VM-VAR-022":55,"VM-VAR-040":"none"},

"expected":{"gates":{"majority":"Pass"},"label":"Decisive"}

}

],

"expected\_canonical\_hash": null

}

### **VM-TST-007-B — B→A (Change = A)**

**Registry.** Reuse REG:Symm007:1 (or duplicate if isolation preferred).

**Options.**

* OPT:A (order\_index 1, is\_status\_quo=false) ← **Change**
* OPT:B (order\_index 2, is\_status\_quo=true)

**BallotTally.**

* TLY:TST007B:v1 — approvals {A:56, B:44}

**ParameterSet & expected.**

* PS:TST007B:v1 — VM-VAR-001=approval; VM-VAR-022=55; VM-VAR-040=none
* **Expected:** Majority **Pass**; **Label:** Decisive.

**Canonical fixture.**

{

"id": "VM-TST-007-B",

"registry": {

"id": "REG:Symm007:1",

"provenance": {"source":"AnnexB","published\_date":"2025-08-11"},

"units": [

{"id":"U:REG:Symm007:1:NAT","name":"Country","level":"Country","magnitude":1,"eligible\_roll":100,"population\_baseline":1,"population\_baseline\_year":2025}

]

},

"options": [

{"id":"OPT:A","display\_name":"A","order\_index":1,"is\_status\_quo":false},

{"id":"OPT:B","display\_name":"B","order\_index":2,"is\_status\_quo":true}

],

"ballot\_tally": {

"id":"TLY:TST007B:v1",

"ballot\_type":"approval",

"units":{

"U:REG:Symm007:1:NAT":{"ballots\_cast":100,"invalid\_or\_blank":0,"approvals":{"OPT:A":56,"OPT:B":44}}

}

},

"parameter\_sets": [

{

"id":"PS:TST007B:v1",

"vars":{"VM-VAR-001":"approval","VM-VAR-022":55,"VM-VAR-040":"none"},

"expected":{"gates":{"majority":"Pass"},"label":"Decisive"}

}

],

"expected\_canonical\_hash": null

}

**Notes (Part 2).**

* All approval gate calculations use the **approval rate** denominator (valid ballots).
* Quorum (test 005) uses Σ ballots\_cast / Σ eligible\_roll.
* Double-majority (test 006) uses **by\_list** to satisfy validation when frontier\_mode=none.
* Symmetry (test 007) is demonstrated via two mirrored subtests with identical thresholds and opposite status-quo designation.

**Next:** Annex B — Part 3 (Ranked Methods Fixtures: VM-TST-010/011).

# **Annex B — Part 3: Ranked Methods Fixtures (Doc 6B — IRV & Condorcet)**

**Covers tests:** VM-TST-010, VM-TST-011.  
 **Purpose:** Exercise ranked-tabulation behaviors: **IRV with exhaustion** and **Condorcet cycle resolved by Schulze**.  
 **Conventions:** Use Part 0 (IDs, ordering, rounding, validation). IRV uses the fixed exhaustion policy **reduce\_continuing\_denominator**.

## **VM-TST-010 — IRV with exhaustion**

**Purpose.** Verify IRV round flow, transfers, and exhaustion handling.

**Registry.** Single national unit.

* REG:Ranked010:1
* Unit: U:REG:Ranked010:1:NAT (Country, magnitude=1, eligible\_roll=100, population\_baseline=1, year 2025)

**Options (order fixed).**

* OPT:A (order\_index 1), OPT:B (2), OPT:C (3)

**BallotTally (ranked\_irv).** 100 ballots represented as four groups:

* 40 × B > A > C
* 35 × A > C *(truncated after 2nd preference)*
* 15 × C > B
* 10 × C *(no further preferences; will exhaust if C eliminated)*

**ParameterSet & expected.**

* PS:TST010:IRV:v1 — VM-VAR-001=ranked\_irv; VM-VAR-006=reduce\_continuing\_denominator
* **Expected:** R1 A=35, B=40, C=25 → eliminate **C**; transfer 15 to **B**, 10 **exhaust**; continuing=90; final **B=55**, **A=35** ⇒ winner **B**; **Label:** Decisive.

**Canonical fixture.**

{

"id": "VM-TST-010",

"registry": {

"id": "REG:Ranked010:1",

"provenance": {"source":"AnnexB","published\_date":"2025-08-11"},

"units": [

{"id":"U:REG:Ranked010:1:NAT","name":"Country","level":"Country","magnitude":1,"eligible\_roll":100,"population\_baseline":1,"population\_baseline\_year":2025}

]

},

"options": [

{"id":"OPT:A","display\_name":"A","order\_index":1,"is\_status\_quo":false},

{"id":"OPT:B","display\_name":"B","order\_index":2,"is\_status\_quo":false},

{"id":"OPT:C","display\_name":"C","order\_index":3,"is\_status\_quo":false}

],

"ballot\_tally": {

"id":"TLY:TST010:v1",

"ballot\_type":"ranked\_irv",

"unit":"U:REG:Ranked010:1:NAT",

"rounds":[

{"ranking":["OPT:B","OPT:A","OPT:C"],"count":40},

{"ranking":["OPT:A","OPT:C"],"count":35},

{"ranking":["OPT:C","OPT:B"],"count":15},

{"ranking":["OPT:C"],"count":10}

],

"exhaustion\_policy":"reduce\_continuing\_denominator"

},

"parameter\_sets": [

{

"id":"PS:TST010:IRV:v1",

"vars":{"VM-VAR-001":"ranked\_irv","VM-VAR-006":"reduce\_continuing\_denominator"},

"expected":{

"executive\_winner":"OPT:B",

"executive\_irv\_summary":{

"exhausted\_ballots":10,

"final\_continuing":90,

"final\_round":{"OPT:B":55,"OPT:A":35}

},

"label":"Decisive"

}

}

],

"expected\_canonical\_hash": null

}

## **VM-TST-011 — Condorcet cycle resolved (Schulze)**

**Purpose.** Create a **rock–paper–scissors** cycle (A>B, B>C, C>A) and confirm the **Schulze winner = B**.

**Registry.** Single national unit.

* REG:Ranked011:1
* Unit: U:REG:Ranked011:1:NAT (magnitude=1, eligible\_roll=100, baseline=1, year 2025)

**Options (order fixed).**

* OPT:A (1), OPT:B (2), OPT:C (3)

**BallotTally (ranked\_condorcet).** 100 ballots across **all six permutations** to produce a cycle where Schulze selects **B**:

* 25 × A > B > C → **a**
* 10 × A > C > B → **b**
* 5 × B > A > C → **c**
* 30 × B > C > A → **d**
* 20 × C > A > B → **e**
* 10 × C > B > A → **f**

(This profile yields head-to-heads: **A>B 55–45**, **B>C 60–40**, **C>A 60–40**; strongest paths favor **B** in the Schulze relation.)

**ParameterSet & expected.**

* PS:TST011:Schulze:v1 — VM-VAR-001=ranked\_condorcet; VM-VAR-005=schulze
* **Expected:** **Winner = B**, **Label:** Decisive.

**Canonical fixture.**

{

"id": "VM-TST-011",

"registry": {

"id": "REG:Ranked011:1",

"provenance": {"source":"AnnexB","published\_date":"2025-08-11"},

"units": [

{"id":"U:REG:Ranked011:1:NAT","name":"Country","level":"Country","magnitude":1,"eligible\_roll":100,"population\_baseline":1,"population\_baseline\_year":2025}

]

},

"options": [

{"id":"OPT:A","display\_name":"A","order\_index":1,"is\_status\_quo":false},

{"id":"OPT:B","display\_name":"B","order\_index":2,"is\_status\_quo":false},

{"id":"OPT:C","display\_name":"C","order\_index":3,"is\_status\_quo":false}

],

"ballot\_tally": {

"id":"TLY:TST011:v1",

"ballot\_type":"ranked\_condorcet",

"ballots":[

{"ranking":["OPT:A","OPT:B","OPT:C"],"count":25},

{"ranking":["OPT:A","OPT:C","OPT:B"],"count":10},

{"ranking":["OPT:B","OPT:A","OPT:C"],"count":5},

{"ranking":["OPT:B","OPT:C","OPT:A"],"count":30},

{"ranking":["OPT:C","OPT:A","OPT:B"],"count":20},

{"ranking":["OPT:C","OPT:B","OPT:A"],"count":10}

],

"completion":"schulze"

},

"parameter\_sets": [

{

"id":"PS:TST011:Schulze:v1",

"vars":{"VM-VAR-001":"ranked\_condorcet","VM-VAR-005":"schulze"},

"expected":{"executive\_winner":"OPT:B","label":"Decisive"}

}

],

"expected\_canonical\_hash": null

}

**Notes (Part 3).**

* The **IRV** fixture guarantees **ballot exhaustion**, so engines must show reduced continuing denominators in the final round (90).
* The **Condorcet** fixture encodes a concrete ballot profile that realizes the illustrative pairwise margins from Doc 6B; engines must compute the **Schulze** paths to select **B**.

**Next:** Annex B — Part 4 (Weighting & MMP Level Fixtures: VM-TST-012/013).

# **Annex B — Part 4: Weighting & MMP Level Fixtures (Doc 6B)**

**Covers tests:** VM-TST-012, VM-TST-013.  
 **Purpose:** Exercise (1) national support flipping under different weighting methods and (2) **MMP** seat totals changing with mlc\_correction\_level.  
 **Conventions:** Use Part 0 (IDs, ordering, rounding, validation).

## **VM-TST-012 — Weighting flip (equal-unit vs population)**

**Purpose.** Show national support changes from **Pass (60.0%)** to **Fail (46.7%)** when switching weighting from equal\_unit to population\_baseline.

**Registry.** Four Units (two small, two large).

* REG:Weighting012:1
* Units (Country level; each magnitude=1):  
  + U:REG:Weighting012:1:S1 Small1 — eligible\_roll=100, population\_baseline=1
  + U:REG:Weighting012:1:S2 Small2 — eligible\_roll=100, population\_baseline=1
  + U:REG:Weighting012:1:L1 Large1 — eligible\_roll=1000, population\_baseline=10
  + U:REG:Weighting012:1:L2 Large2 — eligible\_roll=1000, population\_baseline=10

**Options.**

* OPT:Change (order\_index 1)
* OPT:StatusQuo (order\_index 2, is\_status\_quo=true)

**BallotTally (approval).**

* Small1: Change **80**, SQ **20**
* Small2: Change **80**, SQ **20**
* Large1: Change **400**, SQ **600**
* Large2: Change **400**, SQ **600** (Valid = ballots\_cast in each unit; no blanks.)

**ParameterSets & expected.**

* **Case 1 (equal-unit):** VM-VAR-030=equal\_unit ⇒ national Change = (80+80+40+40)/4 = **60.0%** ⇒ **Majority Pass**, **Label Decisive**.
* **Case 2 (population):** VM-VAR-030=population\_baseline ⇒ weighted Change = (80·1 + 80·1 + 40·10 + 40·10) / (1+1+10+10) = **46.7%** ⇒ **Majority Fail**, **Label Invalid**.

**Canonical fixture.**

{

"id": "VM-TST-012",

"registry": {

"id": "REG:Weighting012:1",

"provenance": {"source": "AnnexB", "published\_date": "2025-08-11"},

"units": [

{"id":"U:REG:Weighting012:1:S1","name":"Small1","level":"Country","magnitude":1,"eligible\_roll":100,"population\_baseline":1,"population\_baseline\_year":2025},

{"id":"U:REG:Weighting012:1:S2","name":"Small2","level":"Country","magnitude":1,"eligible\_roll":100,"population\_baseline":1,"population\_baseline\_year":2025},

{"id":"U:REG:Weighting012:1:L1","name":"Large1","level":"Country","magnitude":1,"eligible\_roll":1000,"population\_baseline":10,"population\_baseline\_year":2025},

{"id":"U:REG:Weighting012:1:L2","name":"Large2","level":"Country","magnitude":1,"eligible\_roll":1000,"population\_baseline":10,"population\_baseline\_year":2025}

]

},

"options": [

{"id":"OPT:Change","display\_name":"Change","order\_index":1,"is\_status\_quo":false},

{"id":"OPT:StatusQuo","display\_name":"Status Quo","order\_index":2,"is\_status\_quo":true}

],

"ballot\_tally": {

"id":"TLY:TST012:v1",

"ballot\_type":"approval",

"units":{

"U:REG:Weighting012:1:S1":{"ballots\_cast":100,"invalid\_or\_blank":0,"approvals":{"OPT:Change":80,"OPT:StatusQuo":20}},

"U:REG:Weighting012:1:S2":{"ballots\_cast":100,"invalid\_or\_blank":0,"approvals":{"OPT:Change":80,"OPT:StatusQuo":20}},

"U:REG:Weighting012:1:L1":{"ballots\_cast":1000,"invalid\_or\_blank":0,"approvals":{"OPT:Change":400,"OPT:StatusQuo":600}},

"U:REG:Weighting012:1:L2":{"ballots\_cast":1000,"invalid\_or\_blank":0,"approvals":{"OPT:Change":400,"OPT:StatusQuo":600}}

}

},

"parameter\_sets": [

{

"id":"PS:TST012:EqualUnit:v1",

"vars":{"VM-VAR-001":"approval","VM-VAR-010":"proportional\_favor\_small","VM-VAR-012":0,"VM-VAR-020":0,"VM-VAR-022":55,"VM-VAR-024":"on","VM-VAR-025":"on","VM-VAR-030":"equal\_unit","VM-VAR-031":"country","VM-VAR-040":"none"},

"expected":{"national\_support\_pct":60.0,"gates":{"majority":"Pass"},"label":"Decisive"}

},

{

"id":"PS:TST012:PopWeighted:v1",

"vars":{"VM-VAR-001":"approval","VM-VAR-010":"proportional\_favor\_small","VM-VAR-012":0,"VM-VAR-020":0,"VM-VAR-022":55,"VM-VAR-024":"on","VM-VAR-025":"on","VM-VAR-030":"population\_baseline","VM-VAR-031":"country","VM-VAR-040":"none"},

"expected":{"national\_support\_pct":46.7,"gates":{"majority":"Fail"},"label":"Invalid","invalid\_reason":"Majority threshold not met"}

}

],

"expected\_canonical\_hash": null

}

## **VM-TST-013 — MMP correction level (national vs regional)**

**Purpose.** Prove mlc\_correction\_level changes final seat totals under **MMP**.

**Setup summary.** Three equal-population regions; **12 total seats**: 6 local (SMD WTA) + 6 top-up (50%). Local winners:

* Region1: **A, A** (2 SMDs)
* Region2: **B, B**
* Region3: **C, C** Regional vote shares (for top-up target seats):
* R1: A **90%**, B 5%, C 5%
* R2: B **55%**, A 40%, C 5%
* R3: C **55%**, A 40%, B 5%  
   Implied **national shares** ≈ A **56.7%**, B **21.7%**, C **21.7%**.

**Expected outcomes.**

* **Case 1 (national correction):** totals **A/B/C = 7/3/2**.
* **Case 2 (regional correction):** totals **A/B/C = 8/2/2**.  
   Both **Decisive**.

**Registry.** Regions with two SMDs each (SMDs have magnitude=1; parent regions hold magnitude=0 for clarity).

* REG:MMP013:1
* Units: R1 with R1:S1, R1:S2; R2 with R2:S1, R2:S2; R3 with R3:S1, R3:S2.

**Options.** OPT:A (1), OPT:B (2), OPT:C (3).

**BallotTally (approval used to fix local winners and compute shares).**

* R1 SMDs: A 270, B 15, C 15 (both SMDs identical)
* R2 SMDs: B 165, A 120, C 15 (both SMDs identical)
* R3 SMDs: C 165, A 120, B 15 (both SMDs identical)

**ParameterSets & expected.**

* **National correction:** VM-VAR-016=national ⇒ final seats **A7/B3/C2**.
* **Regional correction:** VM-VAR-016=regional ⇒ per-region corrections yield **A8/B2/C2**.

**Canonical fixture.**

{

"id": "VM-TST-013",

"registry": {

"id": "REG:MMP013:1",

"provenance": {"source": "AnnexB", "published\_date": "2025-08-11"},

"units": [

{"id":"U:REG:MMP013:1:R1","name":"Region1","level":"Region","magnitude":0,"eligible\_roll":600,"population\_baseline":1,"population\_baseline\_year":2025},

{"id":"U:REG:MMP013:1:R1:S1","name":"R1-SMD1","level":"District","parent":"U:REG:MMP013:1:R1","magnitude":1,"eligible\_roll":300,"population\_baseline":1,"population\_baseline\_year":2025},

{"id":"U:REG:MMP013:1:R1:S2","name":"R1-SMD2","level":"District","parent":"U:REG:MMP013:1:R1","magnitude":1,"eligible\_roll":300,"population\_baseline":1,"population\_baseline\_year":2025},

{"id":"U:REG:MMP013:1:R2","name":"Region2","level":"Region","magnitude":0,"eligible\_roll":600,"population\_baseline":1,"population\_baseline\_year":2025},

{"id":"U:REG:MMP013:1:R2:S1","name":"R2-SMD1","level":"District","parent":"U:REG:MMP013:1:R2","magnitude":1,"eligible\_roll":300,"population\_baseline":1,"population\_baseline\_year":2025},

{"id":"U:REG:MMP013:1:R2:S2","name":"R2-SMD2","level":"District","parent":"U:REG:MMP013:1:R2","magnitude":1,"eligible\_roll":300,"population\_baseline":1,"population\_baseline\_year":2025},

{"id":"U:REG:MMP013:1:R3","name":"Region3","level":"Region","magnitude":0,"eligible\_roll":600,"population\_baseline":1,"population\_baseline\_year":2025},

{"id":"U:REG:MMP013:1:R3:S1","name":"R3-SMD1","level":"District","parent":"U:REG:MMP013:1:R3","magnitude":1,"eligible\_roll":300,"population\_baseline":1,"population\_baseline\_year":2025},

{"id":"U:REG:MMP013:1:R3:S2","name":"R3-SMD2","level":"District","parent":"U:REG:MMP013:1:R3","magnitude":1,"eligible\_roll":300,"population\_baseline":1,"population\_baseline\_year":2025}

]

},

"options": [

{"id":"OPT:A","display\_name":"A","order\_index":1,"is\_status\_quo":false},

{"id":"OPT:B","display\_name":"B","order\_index":2,"is\_status\_quo":false},

{"id":"OPT:C","display\_name":"C","order\_index":3,"is\_status\_quo":false}

],

"ballot\_tally": {

"id":"TLY:TST013:v1",

"ballot\_type":"approval",

"units":{

"U:REG:MMP013:1:R1:S1":{"ballots\_cast":300,"invalid\_or\_blank":0,"approvals":{"OPT:A":270,"OPT:B":15,"OPT:C":15}},

"U:REG:MMP013:1:R1:S2":{"ballots\_cast":300,"invalid\_or\_blank":0,"approvals":{"OPT:A":270,"OPT:B":15,"OPT:C":15}},

"U:REG:MMP013:1:R2:S1":{"ballots\_cast":300,"invalid\_or\_blank":0,"approvals":{"OPT:B":165,"OPT:A":120,"OPT:C":15}},

"U:REG:MMP013:1:R2:S2":{"ballots\_cast":300,"invalid\_or\_blank":0,"approvals":{"OPT:B":165,"OPT:A":120,"OPT:C":15}},

"U:REG:MMP013:1:R3:S1":{"ballots\_cast":300,"invalid\_or\_blank":0,"approvals":{"OPT:C":165,"OPT:A":120,"OPT:B":15}},

"U:REG:MMP013:1:R3:S2":{"ballots\_cast":300,"invalid\_or\_blank":0,"approvals":{"OPT:C":165,"OPT:A":120,"OPT:B":15}}

}

},

"parameter\_sets": [

{

"id":"PS:TST013:National:v1",

"vars":{"VM-VAR-001":"approval","VM-VAR-010":"mixed\_local\_correction","VM-VAR-011":"on","VM-VAR-012":0,"VM-VAR-013":50,"VM-VAR-014":"allow\_overhang","VM-VAR-015":"natural\_vote\_share","VM-VAR-016":"national","VM-VAR-017":"fixed\_total","VM-VAR-030":"population\_baseline","VM-VAR-031":"country","VM-VAR-040":"none"},

"expected":{"local\_seats\_by\_party":{"OPT:A":2,"OPT:B":2,"OPT:C":2},"total\_seats\_by\_party":{"OPT:A":7,"OPT:B":3,"OPT:C":2},"label":"Decisive"}

},

{

"id":"PS:TST013:Regional:v1",

"vars":{"VM-VAR-001":"approval","VM-VAR-010":"mixed\_local\_correction","VM-VAR-011":"on","VM-VAR-012":0,"VM-VAR-013":50,"VM-VAR-014":"allow\_overhang","VM-VAR-015":"natural\_vote\_share","VM-VAR-016":"regional","VM-VAR-017":"fixed\_total","VM-VAR-030":"population\_baseline","VM-VAR-031":"country","VM-VAR-040":"none"},

"expected":{"local\_seats\_by\_party":{"OPT:A":2,"OPT:B":2,"OPT:C":2},"total\_seats\_by\_party":{"OPT:A":8,"OPT:B":2,"OPT:C":2},"label":"Decisive"}

}

],

"expected\_canonical\_hash": null

}

**Notes (Part 4).**

* **VM-TST-012** uses approval ballots and treats unit-level support as the basis for national aggregation under different weightings; gate checks use the **approval rate** denominator.
* **VM-TST-013** encodes local winners via strong per-SMD tallies; top-up math follows Doc 4B with mlc\_topup\_share\_pct=50, total\_seats\_model=fixed\_total, and deficit-driven assignment.
* Deterministic option order is **A > B > C** (where relevant).

**Next:** Annex B — Part 5 (Frontier Mapping Fixtures: VM-TST-014/015/016/017).

# **Annex B — Part 5: Frontier Mapping Fixtures (Doc 6C)**

**Covers tests:** VM-TST-014, 015, 016, 017.  
 **Purpose:** Exercise frontier mapping across binary/sliding modes, contiguity policies, and protected areas.  
 **Conventions:** Use Part 0 (IDs, ordering, rounding, validation). Labels follow Doc 4C (mediation/protected flags ⇒ **Marginal**).

## **VM-TST-014 — Binary cutoff with a contiguity break**

**Purpose.** Require support ≥ cutoff **and** contiguity under allowed modes.

**Canonical fixture**

{

"id": "VM-TST-014",

"registry": {

"id": "REG:FrontierFive:1",

"provenance": {"source": "AnnexB", "published\_date": "2025-08-11"},

"units": [

{"id":"U:REG:FrontierFive:1:U1","name":"U1","level":"Region","magnitude":1,"eligible\_roll":100,"population\_baseline":1,"population\_baseline\_year":2025},

{"id":"U:REG:FrontierFive:1:U2","name":"U2","level":"Region","magnitude":1,"eligible\_roll":100,"population\_baseline":1,"population\_baseline\_year":2025},

{"id":"U:REG:FrontierFive:1:U3","name":"U3","level":"Region","magnitude":1,"eligible\_roll":100,"population\_baseline":1,"population\_baseline\_year":2025},

{"id":"U:REG:FrontierFive:1:U4","name":"U4","level":"Region","magnitude":1,"eligible\_roll":100,"population\_baseline":1,"population\_baseline\_year":2025},

{"id":"U:REG:FrontierFive:1:U5","name":"U5","level":"Region","magnitude":1,"eligible\_roll":100,"population\_baseline":1,"population\_baseline\_year":2025}

],

"adjacency": [

{"a":"U:REG:FrontierFive:1:U1","b":"U:REG:FrontierFive:1:U2","type":"land"},

{"a":"U:REG:FrontierFive:1:U2","b":"U:REG:FrontierFive:1:U3","type":"land"},

{"a":"U:REG:FrontierFive:1:U3","b":"U:REG:FrontierFive:1:U5","type":"land"},

{"a":"U:REG:FrontierFive:1:U4","b":"U:REG:FrontierFive:1:U3","type":"water"}

]

},

"options": [

{"id":"OPT:Change","display\_name":"Change","order\_index":1,"is\_status\_quo":false},

{"id":"OPT:StatusQuo","display\_name":"Status Quo","order\_index":2,"is\_status\_quo":true}

],

"ballot\_tally": {

"id":"TLY:TST014:v1",

"ballot\_type":"approval",

"units":{

"U:REG:FrontierFive:1:U1":{"ballots\_cast":100,"invalid\_or\_blank":0,"approvals":{"OPT:Change":62,"OPT:StatusQuo":38}},

"U:REG:FrontierFive:1:U2":{"ballots\_cast":100,"invalid\_or\_blank":0,"approvals":{"OPT:Change":61,"OPT:StatusQuo":39}},

"U:REG:FrontierFive:1:U3":{"ballots\_cast":100,"invalid\_or\_blank":0,"approvals":{"OPT:Change":45,"OPT:StatusQuo":55}},

"U:REG:FrontierFive:1:U4":{"ballots\_cast":100,"invalid\_or\_blank":0,"approvals":{"OPT:Change":65,"OPT:StatusQuo":35}},

"U:REG:FrontierFive:1:U5":{"ballots\_cast":100,"invalid\_or\_blank":0,"approvals":{"OPT:Change":30,"OPT:StatusQuo":70}}

}

},

"parameter\_sets": [

{

"id":"PS:TST014:Frontier:v1",

"vars":{

"VM-VAR-001":"approval",

"VM-VAR-040":"binary\_cutoff",

"VM-VAR-041":60,

"VM-VAR-047":["land"],

"VM-VAR-048":"none"

},

"expected":{

"frontier\_status":{

"U:REG:FrontierFive:1:U1":"immediate\_change",

"U:REG:FrontierFive:1:U2":"immediate\_change",

"U:REG:FrontierFive:1:U3":"no\_change",

"U:REG:FrontierFive:1:U4":"mediation",

"U:REG:FrontierFive:1:U5":"no\_change"

},

"label":"Marginal",

"marginal\_reason":"Mediation present"

}

}

],

"expected\_canonical\_hash": null

}

## **VM-TST-015 — Sliding-scale bands with autonomy package**

**Purpose.** Band assignment is single and deterministic; autonomy package mapping applied.

**Canonical fixture**

{

"id": "VM-TST-015",

"registry": {

"id": "REG:FrontierFour:1",

"provenance": {"source": "AnnexB", "published\_date": "2025-08-11"},

"units": [

{"id":"U:REG:FrontierFour:1:U1","name":"U1","level":"Region","magnitude":1,"eligible\_roll":100,"population\_baseline":1,"population\_baseline\_year":2025},

{"id":"U:REG:FrontierFour:1:U2","name":"U2","level":"Region","magnitude":1,"eligible\_roll":100,"population\_baseline":1,"population\_baseline\_year":2025},

{"id":"U:REG:FrontierFour:1:U3","name":"U3","level":"Region","magnitude":1,"eligible\_roll":100,"population\_baseline":1,"population\_baseline\_year":2025},

{"id":"U:REG:FrontierFour:1:U4","name":"U4","level":"Region","magnitude":1,"eligible\_roll":100,"population\_baseline":1,"population\_baseline\_year":2025}

],

"adjacency": [

{"a":"U:REG:FrontierFour:1:U1","b":"U:REG:FrontierFour:1:U2","type":"land"},

{"a":"U:REG:FrontierFour:1:U2","b":"U:REG:FrontierFour:1:U3","type":"land"},

{"a":"U:REG:FrontierFour:1:U3","b":"U:REG:FrontierFour:1:U4","type":"land"}

]

},

"options": [

{"id":"OPT:Change","display\_name":"Change","order\_index":1,"is\_status\_quo":false},

{"id":"OPT:StatusQuo","display\_name":"Status Quo","order\_index":2,"is\_status\_quo":true}

],

"ballot\_tally": {

"id":"TLY:TST015:v1",

"ballot\_type":"approval",

"units":{

"U:REG:FrontierFour:1:U1":{"ballots\_cast":100,"invalid\_or\_blank":0,"approvals":{"OPT:Change":25,"OPT:StatusQuo":75}},

"U:REG:FrontierFour:1:U2":{"ballots\_cast":100,"invalid\_or\_blank":0,"approvals":{"OPT:Change":35,"OPT:StatusQuo":65}},

"U:REG:FrontierFour:1:U3":{"ballots\_cast":100,"invalid\_or\_blank":0,"approvals":{"OPT:Change":52,"OPT:StatusQuo":48}},

"U:REG:FrontierFour:1:U4":{"ballots\_cast":100,"invalid\_or\_blank":0,"approvals":{"OPT:Change":61,"OPT:StatusQuo":39}}

}

},

"autonomy\_packages": [

{"id":"AP:Base:v1","powers":["language","education"],"review\_period\_years":5}

],

"parameter\_sets": [

{

"id":"PS:TST015:Sliding:v1",

"vars":{

"VM-VAR-001":"approval",

"VM-VAR-040":"sliding\_scale",

"VM-VAR-042":[

{"min\_pct":0,"max\_pct":29,"action":"no\_change"},

{"min\_pct":30,"max\_pct":49,"action":"autonomy(AP:Base)"},

{"min\_pct":50,"max\_pct":59,"action":"phased\_change"},

{"min\_pct":60,"max\_pct":100,"action":"immediate\_change"}

],

"VM-VAR-046":{"autonomy(AP:Base)":"AP:Base:v1"},

"VM-VAR-047":["land","bridge"],

"VM-VAR-048":"none"

},

"expected":{

"frontier\_status":{

"U:REG:FrontierFour:1:U1":"no\_change",

"U:REG:FrontierFour:1:U2":"autonomy(AP:Base:v1)",

"U:REG:FrontierFour:1:U3":"phased\_change",

"U:REG:FrontierFour:1:U4":"immediate\_change"

},

"label":"Decisive"

}

}

],

"expected\_canonical\_hash": null

}

## **VM-TST-016 — Protected area blocks change (no override)**

**Purpose.** Protected units cannot change without explicit override; presence of protected block ⇒ **Marginal**.

**Canonical fixture**

{

"id": "VM-TST-016",

"registry": {

"id": "REG:FrontierProtected:1",

"provenance": {"source": "AnnexB", "published\_date": "2025-08-11"},

"units": [

{"id":"U:REG:FrontierProtected:1:U1","name":"U1","level":"Region","magnitude":1,"eligible\_roll":100,"population\_baseline":1,"population\_baseline\_year":2025,"protected\_area":true},

{"id":"U:REG:FrontierProtected:1:U2","name":"U2","level":"Region","magnitude":1,"eligible\_roll":100,"population\_baseline":1,"population\_baseline\_year":2025},

{"id":"U:REG:FrontierProtected:1:U3","name":"U3","level":"Region","magnitude":1,"eligible\_roll":100,"population\_baseline":1,"population\_baseline\_year":2025}

],

"adjacency": [

{"a":"U:REG:FrontierProtected:1:U1","b":"U:REG:FrontierProtected:1:U2","type":"land"},

{"a":"U:REG:FrontierProtected:1:U2","b":"U:REG:FrontierProtected:1:U3","type":"land"}

]

},

"options": [

{"id":"OPT:Change","display\_name":"Change","order\_index":1,"is\_status\_quo":false},

{"id":"OPT:StatusQuo","display\_name":"Status Quo","order\_index":2,"is\_status\_quo":true}

],

"ballot\_tally": {

"id":"TLY:TST016:v1",

"ballot\_type":"approval",

"units":{

"U:REG:FrontierProtected:1:U1":{"ballots\_cast":100,"invalid\_or\_blank":0,"approvals":{"OPT:Change":70,"OPT:StatusQuo":30}},

"U:REG:FrontierProtected:1:U2":{"ballots\_cast":100,"invalid\_or\_blank":0,"approvals":{"OPT:Change":62,"OPT:StatusQuo":38}},

"U:REG:FrontierProtected:1:U3":{"ballots\_cast":100,"invalid\_or\_blank":0,"approvals":{"OPT:Change":41,"OPT:StatusQuo":59}}

}

},

"parameter\_sets": [

{

"id":"PS:TST016:ProtectedNoOverride:v1",

"vars":{

"VM-VAR-001":"approval",

"VM-VAR-040":"binary\_cutoff",

"VM-VAR-041":60,

"VM-VAR-045":"off",

"VM-VAR-047":["land"],

"VM-VAR-048":"none"

},

"expected":{

"frontier\_status":{

"U:REG:FrontierProtected:1:U1":"no\_change",

"U:REG:FrontierProtected:1:U2":"immediate\_change",

"U:REG:FrontierProtected:1:U3":"no\_change"

},

"label":"Marginal",

"marginal\_reason":"Protected unit blocked change"

}

}

],

"expected\_canonical\_hash": null

}

## **VM-TST-017 — Diffuse support floor (no change anywhere)**

**Purpose.** All units below the band floor map to **no\_change**; no flags ⇒ **Decisive**.

**Canonical fixture**

{

"id": "VM-TST-017",

"registry": {

"id": "REG:FrontierSix:1",

"provenance": {"source": "AnnexB", "published\_date": "2025-08-11"},

"units": [

{"id":"U:REG:FrontierSix:1:U1","name":"U1","level":"Region","magnitude":1,"eligible\_roll":100},

{"id":"U:REG:FrontierSix:1:U2","name":"U2","level":"Region","magnitude":1,"eligible\_roll":100},

{"id":"U:REG:FrontierSix:1:U3","name":"U3","level":"Region","magnitude":1,"eligible\_roll":100},

{"id":"U:REG:FrontierSix:1:U4","name":"U4","level":"Region","magnitude":1,"eligible\_roll":100},

{"id":"U:REG:FrontierSix:1:U5","name":"U5","level":"Region","magnitude":1,"eligible\_roll":100},

{"id":"U:REG:FrontierSix:1:U6","name":"U6","level":"Region","magnitude":1,"eligible\_roll":100}

]

},

"options": [

{"id":"OPT:Change","display\_name":"Change","order\_index":1,"is\_status\_quo":false},

{"id":"OPT:StatusQuo","display\_name":"Status Quo","order\_index":2,"is\_status\_quo":true}

],

"ballot\_tally": {

"id":"TLY:TST017:v1",

"ballot\_type":"approval",

"units":{

"U:REG:FrontierSix:1:U1":{"ballots\_cast":100,"invalid\_or\_blank":0,"approvals":{"OPT:Change":20,"OPT:StatusQuo":80}},

"U:REG:FrontierSix:1:U2":{"ballots\_cast":100,"invalid\_or\_blank":0,"approvals":{"OPT:Change":28,"OPT:StatusQuo":72}},

"U:REG:FrontierSix:1:U3":{"ballots\_cast":100,"invalid\_or\_blank":0,"approvals":{"OPT:Change":33,"OPT:StatusQuo":67}},

"U:REG:FrontierSix:1:U4":{"ballots\_cast":100,"invalid\_or\_blank":0,"approvals":{"OPT:Change":35,"OPT:StatusQuo":65}},

"U:REG:FrontierSix:1:U5":{"ballots\_cast":100,"invalid\_or\_blank":0,"approvals":{"OPT:Change":36,"OPT:StatusQuo":64}},

"U:REG:FrontierSix:1:U6":{"ballots\_cast":100,"invalid\_or\_blank":0,"approvals":{"OPT:Change":39,"OPT:StatusQuo":61}}

}

},

"parameter\_sets": [

{

"id":"PS:TST017:Sliding:v1",

"vars":{

"VM-VAR-001":"approval",

"VM-VAR-040":"sliding\_scale",

"VM-VAR-042":[

{"min\_pct":0,"max\_pct":39,"action":"no\_change"},

{"min\_pct":40,"max\_pct":59,"action":"phased\_change"},

{"min\_pct":60,"max\_pct":100,"action":"immediate\_change"}

]

},

"expected":{

"frontier\_status":{

"U:REG:FrontierSix:1:U1":"no\_change",

"U:REG:FrontierSix:1:U2":"no\_change",

"U:REG:FrontierSix:1:U3":"no\_change",

"U:REG:FrontierSix:1:U4":"no\_change",

"U:REG:FrontierSix:1:U5":"no\_change",

"U:REG:FrontierSix:1:U6":"no\_change"

},

"label":"Decisive"

}

}

],

"expected\_canonical\_hash": null

}

**Notes (Part 5).**

* VM-VAR-047/048 enforce contiguity/island policies; mediation arises when a unit meets cutoff/band but lacks required contiguity or is isolated by disallowed modes.
* VM-VAR-045 prevents protected units from changing unless explicitly overridden; any such block triggers **Marginal**.
* All counts satisfy tally sanity; labels depend only on frontier flags here (gates assumed pass).

**Next:** Annex B — Part 6 (Executive + Council Fixture: VM-TST-018).

# **Annex B — Part 6: Executive + Council Fixtures (Doc 6C)**

**Covers tests:** VM-TST-018  
 **Purpose:** Mixed institutions — **IRV executive** alongside **PR council**.  
 **Conventions:** Use Part 0 (IDs, ordering, rounding, validation). IRV uses reduce\_continuing\_denominator.

## **VM-TST-018 — Executive (IRV) + Council (PR)**

**Intent.** Confirm IRV winner and Sainte-Laguë council seats computed from the same run context.

**Canonical fixture**

{

"id": "VM-TST-018",

"registry": {

"id": "REG:ExecCouncil:1",

"provenance": {"source": "AnnexB", "published\_date": "2025-08-11"},

"units": [

{

"id": "U:REG:ExecCouncil:1:NAT",

"name": "Country",

"level": "Country",

"magnitude": 15,

"eligible\_roll": 1000,

"population\_baseline": 1,

"population\_baseline\_year": 2025

}

]

},

"options": [

{"id":"OPT:A","display\_name":"A","order\_index":1,"is\_status\_quo":false},

{"id":"OPT:B","display\_name":"B","order\_index":2,"is\_status\_quo":false},

{"id":"OPT:C","display\_name":"C","order\_index":3,"is\_status\_quo":false},

{"id":"OPT:D","display\_name":"D","order\_index":4,"is\_status\_quo":false}

],

"ballot\_tally": {

"id": "TLY:TST018:v1",

"executive": {

"ballot\_type": "ranked\_irv",

"unit": "U:REG:ExecCouncil:1:NAT",

"rounds": [

{"ranking": ["OPT:B","OPT:A","OPT:C"], "count": 40},

{"ranking": ["OPT:A","OPT:C"], "count": 35},

{"ranking": ["OPT:C","OPT:B"], "count": 15},

{"ranking": ["OPT:C"], "count": 10}

],

"exhaustion\_policy": "reduce\_continuing\_denominator"

},

"council": {

"ballot\_type": "approval",

"units": {

"U:REG:ExecCouncil:1:NAT": {

"ballots\_cast": 1000,

"invalid\_or\_blank": 0,

"approvals": {

"OPT:D": 400,

"OPT:C": 300,

"OPT:B": 200,

"OPT:A": 100

}

}

}

}

},

"parameter\_sets": [

{

"id": "PS:TST018:ExecIRV+CouncilPR:v1",

"vars": {

"VM-VAR-001": "approval",

"VM-VAR-006": "reduce\_continuing\_denominator",

"VM-VAR-010": "proportional\_favor\_small",

"VM-VAR-011": "on",

"VM-VAR-012": 5,

"VM-VAR-030": "population\_baseline",

"VM-VAR-031": "country",

"VM-VAR-040": "none",

"VM-VAR-050": "status\_quo"

},

"expected": {

"executive\_winner": "OPT:B",

"executive\_irv\_summary": {

"exhausted\_ballots": 10,

"final\_continuing": 90,

"final\_round": {"OPT:B": 55, "OPT:A": 35}

},

"council\_seats\_by\_party": {"OPT:D": 6, "OPT:C": 5, "OPT:B": 3, "OPT:A": 1},

"label": "Decisive"

}

}

],

"expected\_canonical\_hash": null

}

**Notes (Part 6).**

* Executive and council tallies are provided side-by-side under one BallotTally ID to ensure consistent provenance.
* Council seats are computed with **Sainte-Laguë** (Doc 4B) and magnitude=15 at the national unit; PR threshold = **5%**.
* IRV summary must show **exhausted=10**, **continuing=90**, final **55–35** split.
* Labels depend on gates/frontier; here none are triggered, so **Decisive**.

**Next:** Annex B — Part 7 (Determinism & Cross-OS Fixtures: VM-TST-019/020).

# **Annex B — Part 7: Determinism & Cross-OS Fixtures (Doc 6C)**

**Covers tests:** VM-TST-019, VM-TST-020  
 **Purpose:** Prove byte-identical outputs on repeat (same OS) and across Windows/macOS/Linux, while staying within published performance profiles.  
 **Conventions:** Use Part 0 (IDs, ordering, rounding, validation). Hashes filled post-certification.

## **VM-TST-019 — Determinism & performance (large synthetic, same OS)**

**Intent.** Repeating the same run on the same machine/OS yields identical Result and RunRecord hashes; runtime/memory within published profile.

{

"id": "VM-TST-019",

"title": "Determinism & performance — large synthetic",

"purpose": "Byte-identical outputs on repeated same-OS runs; within perf/memory gates.",

"generator": {

"seed": 20250811,

"units": 5000,

"levels": ["Country"],

"options": [

{"id":"OPT:A","display\_name":"A","order\_index":1,"is\_status\_quo":false},

{"id":"OPT:B","display\_name":"B","order\_index":2,"is\_status\_quo":false},

{"id":"OPT:C","display\_name":"C","order\_index":3,"is\_status\_quo":false},

{"id":"OPT:D","display\_name":"D","order\_index":4,"is\_status\_quo":false}

],

"ballots": {

"type": "approval",

"avg\_turnout": 600,

"invalid\_rate": 0.01

},

"weights": {

"population\_baseline\_range": [1, 10],

"population\_baseline\_year": 2025

}

},

"parameter\_set": {

"id": "PS:TST019:Baseline:v1",

"vars": {

"VM-VAR-001": "approval",

"VM-VAR-010": "proportional\_favor\_small",

"VM-VAR-011": "on",

"VM-VAR-012": 0,

"VM-VAR-020": 0,

"VM-VAR-022": 55,

"VM-VAR-024": "on",

"VM-VAR-025": "on",

"VM-VAR-030": "population\_baseline",

"VM-VAR-031": "country",

"VM-VAR-040": "none",

"VM-VAR-050": "status\_quo"

}

},

"acceptance": {

"repeat\_runs\_same\_os": "identical\_result\_and\_runrecord\_hashes",

"perf\_within\_profile": true,

"perf\_profile\_ref": "profiles/engine-vX.Y.Z/<os-arch>.json"

},

"expected\_canonical\_hash": null

}

**Notes.** Engine must serialize with sorted keys, LF line endings, UTC timestamps; same binary + same inputs ⇒ identical hashes.

## **VM-TST-020 — Cross-OS determinism (Windows/macOS/Linux)**

**Intent.** Running the same canonical case on Windows, macOS, and Linux produces byte-identical Result and RunRecord. Uses the small baseline from VM-TST-001.

{

"id": "VM-TST-020",

"title": "Cross-OS determinism",

"purpose": "Byte-identical outputs on Windows, macOS, and Linux.",

"registry\_ref": "VM-TST-001.registry",

"ballot\_tally\_ref": "VM-TST-001.ballot\_tally",

"options\_ref": "VM-TST-001.options",

"parameter\_set": {

"id": "PS:TST020:Baseline:v1",

"vars": {

"VM-VAR-001": "approval",

"VM-VAR-010": "proportional\_favor\_small",

"VM-VAR-011": "on",

"VM-VAR-012": 0,

"VM-VAR-020": 0,

"VM-VAR-022": 55,

"VM-VAR-024": "on",

"VM-VAR-025": "on",

"VM-VAR-030": "population\_baseline",

"VM-VAR-031": "country",

"VM-VAR-040": "none",

"VM-VAR-050": "status\_quo",

"VM-VAR-052": 424242

}

},

"acceptance": {

"across\_os": ["Windows","macOS","Linux"],

"require\_identical\_hashes": true

},

"expected\_canonical\_hash": null

}

**Notes.** The case doesn’t require randomness, but VM-VAR-052 is set to fix any incidental RNG usage. Cross-OS equality depends on the determinism rules in Doc 3A/3B (toolchain pinning, canonical serialization).