

Doctor Roster Scheduling System

Requirements Bible (Draft v1.2)

Purpose: confirm requirements with the requester before building.

Date: 15 Dec 2025

Owner: Scheduling App Project Team

Audience: Requester, Admins, Team Leads, Developers

Sign-off checklist

- All centers and shift definitions are correct.
- Daily coverage requirements per center are correct.
- Pediatrics rule and allowed daily patterns are correct.
- Hard constraints (hours/rest/sequence) are correct.
- Leave/request workflows match operations.
- Open decisions (Section 12) are agreed.

1. Executive summary

This system builds and manages a monthly schedule (roster) for doctors across multiple centers. Every day of the month must meet minimum coverage per center and shift, while enforcing hard labor constraints: (1) monthly hours (Saudi: 160, Non-Saudi: 192), (2) minimum 12 hours rest, (3) max 3 consecutive working days, and (4) no next-day Day shift after a Night shift. The system also handles annual/emergency leave, sick leave, and approved request-off, and provides a team lead workflow to adjust a draft schedule before publishing.

In scope: doctors only (part-timers excluded). Doctors can float across centers during the same month.

Out of scope (v1): part-time doctors; non-doctor staffing; payroll integration; mobile app; split-shifts in the same day.

Key outcomes

- One source of truth schedule per month, with draft vs published versions.
- Automatic validation of coverage, hours, rest, and forbidden sequences.
- Auto-builder that produces a complete draft month roster respecting hard constraints.
- Operational leave + request handling, with gap alerts and audit trail.

2. Roles and permissions

Role	Capabilities (minimum)
Admin (AD)	Manage all centers, shift templates, users; approve leave; run auto-builder; publish schedule; override constraints with justification; export reports; view audit log.
Team Lead	Edit schedule for assigned team; propose swaps; approve/deny request-off (optional, configurable); view coverage dashboard and constraint warnings; cannot change global templates.
Doctor (employee)	View assigned roster; submit leave and request-off; see approval status; optionally acknowledge schedule receipt.

Note: team leads must be able to change shifts for their team, while the system enforces hard constraints and daily coverage.

3. Shift catalog

Shift code	Type	Start-End	Hours	Notes
D	12h	06:00-18:00	12	Mandatory daily (where allowed)
E	12h	10:00-22:00	12	Mandatory daily (J/G)
N	12h	18:00-06:00	12	Mandatory daily (where allowed)
A	8h	06:00-14:00	8	Mandatory daily (J/G)
B	8h	14:00-22:00	8	Mandatory daily (J/G)
C	8h	22:00-06:00	8	Mandatory daily (J/G)
H	8h	10:00-18:00	8	Optional (used in Pediatrics option 3)
S	8h	18:00-02:00	8	Optional
KD	12h	07:00-19:00	12	Airport (K) day shift
KN	12h	19:00-07:00	12	Airport (K) night shift

4. Centers and daily coverage templates

Coverage is specified as minimum required doctor count per shift per day. All requirements apply every day of the month.

Center code	Center name	Allowed shifts	Daily mandatory coverage
J	Al Narjis Center	A, B, C, D, E, N (+ optional H, S)	J template below + Pediatrics rule
G	Al Ghadir Center	A, B, C, D, E, N (+ optional H, S)	G template below + Pediatrics rule
C	Digital City	D, N	1x D and 1x N
Q	Diplomatic Quarter	D, N	1x D and 1x N
K	Khaled International Airport	KD, KN	1x KD and 1x KN

J daily minimum (Doctors)

Center	A	B	C	D	E	N
J (Doctors)	2	1	1	3	3	3

G daily minimum (Doctors)

Center	A	B	C	D	E	N
G (Doctors)	1	1	1	3	2	2

Important: A, B, C are mandatory every day in J and G. H and S are not mandatory. D, E, N are also mandatory every day in J and G.

5. Pediatrics coverage rule

Pediatrics is an additional coverage rule for J and G that must be satisfied every day. The scheduler may satisfy Pediatrics using one of the allowed daily patterns below.

Option	Daily Pediatrics pattern	Total shifts	Notes
P1	A + D + E + N	4	One pediatrics doctor per listed shift code
P2	D + D + E + N	4	Two pediatrics doctors on D, one on E, one on N
P3	D + A + H + N	4	Uses optional H shift (becomes required when chosen)

Configuration decision: Do Pediatrics assignments count toward the main doctor coverage numbers (recommended) or are they additional on top of the J/G templates?

6. Hard constraints and labor rules

These constraints must hold before a roster can be published. The system must prevent publishing if any hard constraint is violated.

Constraint	Rule
Monthly hours (hard)	Saudi doctors: exactly 160 hours/month. Non-Saudi doctors: exactly 192 hours/month. (Hours are computed from assigned shift durations.)
Minimum rest (hard)	At least 12 hours rest between the end of one shift and the start of the next assigned shift.
Max consecutive working days (hard)	A doctor may work at most 3 consecutive days with any shift. After 3 consecutive working days, at least 1 day off is required.
Forbidden sequence (hard)	No next-day D after working N. If a doctor works N on day X, they cannot work D on day X+1.
No overlap (hard)	A doctor cannot be assigned to more than one shift on the same calendar day.
Leave blocks scheduling (hard)	Approved leave blocks assignments for those dates unless an Admin override is explicitly applied with justification.

Note: The 12-hour rest rule typically blocks many next-day combinations automatically; the explicit 'no D after N' remains enforced even if rest would allow it under some shift definitions.

7. Leave, sick leave, and request-off

Type	Approval	Timing	Effect on scheduling
Annual leave / Emergency leave	Required	Planned ahead (usually)	Blocks assignments; triggers re-balance of hours and coverage
Sick leave	Usually recorded/confirmed	Often same-day or retroactive	Auto-unassigns impacted shifts; flags coverage gaps immediately
Request off	Required	Planned ahead	Blocks assignments if approved; if denied, treated as preference only (optional)

Operational note: if leave reduces available working days, exact monthly hours may become impossible unless the hours target is adjusted for leave. See Open Decisions (Section 12).

8. Scheduling workflow

Monthly cycle

- 1) Configure month period (e.g., Jan 2026) and freeze coverage templates.
- 2) Collect leave / request-off submissions up to a cutoff date.
- 3) Run Auto-Builder to generate a Draft roster.
- 4) Team Leads adjust the draft (swap shifts, reassign centers), with live validation.
- 5) Resolve all coverage gaps and constraint violations.
- 6) Admin publishes the roster (published version is read-only except via controlled change workflow).

In-month operations

- Sick leave is entered -> impacted assignments are removed -> system shows red coverage gaps -> team lead/admin fills gaps and republishes delta (audit logged).

Draft vs published

The system stores at least two versions: Draft (editable) and Published (official). Changes after publishing must be tracked in an audit log.

9. Auto-builder and validation engine

Auto-building is a constraint satisfaction problem. Recommended implementation: Google OR-Tools (CP-SAT) to generate a complete month schedule while enforcing hard constraints.

- Decision variables: assign doctor -> (center, shift) per day.
- Constraints: daily coverage templates, Pediatrics option selection, monthly hours (exact), 12h rest, max 3 consecutive working days, forbidden sequence (no next-day D after N), leave blocks.
- Objective (after satisfying hard constraints): minimize cross-center moves, balance N shifts fairly, keep stable patterns, minimize manual fixes.

Validation must run continuously during manual edits. The UI must show: (a) coverage gaps by day/center/shift, (b) per-doctor hour totals, (c) rest/sequence violations, and (d) consecutive-day warnings.

10. Screens and user experience

Screen	Primary user	What it must do
Roster Month View	Admin, Team Lead	Grid of doctors x days. Each cell shows Center+Shift (e.g., J-D). Drag/drop assign. Inline warnings. Per-doctor hour progress.
Coverage Dashboard	Admin, Team Lead	Per day: required vs assigned counts per center and shift. Highlights red gaps. Shows Pediatrics option met/not met.
Leave & Requests	All (role-based)	Submit and approve annual/emergency leave, sick leave, request-off. Calendar overlay on roster. Status tracking.
Rules & Templates	Admin	Manage centers, allowed shifts, daily coverage numbers, Pediatrics options, hard constraints settings.
Audit Log & Publish	Admin	Track changes, who/when/what. Publish draft to official roster. Export PDF/Excel.

11. Reports and exports

- Monthly roster export (PDF): center-wise and doctor-wise views.
- Excel export for analysis (hours per doctor, shift counts, center assignments).
- Coverage compliance report (per day/center/shift): met vs missing.
- Doctor workload report: total hours, number of N shifts, consecutive working-day streaks.
- Change log report after publish (delta report).

Non-functional requirements (v1)

- Performance: generate a monthly draft in reasonable time (target < 2 minutes for typical staffing levels).
- Reliability: always prevent publishing invalid rosters; allow admin override only with justification.
- Security: role-based access; audit trail for edits and approvals.
- Usability: schedule edits should be fast (keyboard shortcuts and quick swap recommended).

12. Open decisions and confirmation checklist

These items must be confirmed with the requester to finalize the build plan. They are not yet specified as hard requirements.

- Pediatrics counts toward main J/G doctor coverage totals (recommended) OR is additional on top.
- How monthly hours behave with leave: reduce required hours by leave hours (recommended) OR require exact 160/192 regardless.
- Whether doctors can work two shifts in the same day (current assumption: no).
- Whether any doctor has shift restrictions (e.g., cannot do N) - current assumption: none.
- Whether cross-center moves have any limits (e.g., max centers per week) - current assumption: none.

Appendix A - Quick reference (daily minimums)

Center	Daily minimum shifts (doctors)	Notes
J	2A, 1B, 1C, 3D, 3E, 3N + Pediatrics option	All days of month
G	1A, 1B, 1C, 3D, 2E, 2N + Pediatrics option	All days of month
C	1D, 1N	All days of month
Q	1D, 1N	All days of month
K	1KD, 1KN	All days of month

Appendix B - Arabic center names (as provided)

- J: زكرم رنلا س
- G: زكرم دخل ر

Note: Some PDF viewers may display Arabic letters unjoined depending on font shaping support.