

Phase 1 Worksheet: Main Worksheet

“From the problem story to your first sport scheduling method”

Reading scope

- Read pages 1–4 (up to the first paragraph of page 4) of “Scheduling the Main Professional Football League of Argentina.”
- Focus on: the league context, fairness issues, constraints from stakeholders, and the high-level methodology (integer programming and decomposition with cluster patterns).

Learning goals

By the end of this phase you should be able to:

- Restate the scheduling problem, stakeholders, and success criteria in your own words.
- Define concrete fairness metrics and operational constraints implied by the reading.
- Propose at least one complete method for sport scheduling, including data inputs, objective(s), constraints, and a solution approach (algorithmic plan).
- Explain trade-offs and how you would validate a proposed schedule.

Deliverables for Phase 1 (A written or typed report consisting of the following things)

Phase 1 練習需要繳交一份手寫或是打字的書面報告 這是屬於“寫”的練習

- A one-page problem brief (your own words). **(500-700 words) (En)**
- A structured list of fairness metrics and constraints you will use. **(no page limits) (En/Ch)**
- One or more proposed scheduling methods, each with: objectives, constraints, data needed, and algorithm outline or pseudocode. **(no page limits) (En/Ch)**
- A short plan to validate and iterate on a candidate schedule. **(500-700 words) (En)**

Section A. Quick comprehension check (5–10 minutes)

Answer briefly:

- 1) What makes the Argentine First Division scheduling challenging relative to a typical round robin?
- 2) List three fairness issues mentioned in the reading.
- 3) Name at least three external stakeholders and one example constraint or preference from each.
- 4) Why is a purely manual schedule problematic here?
- 5) What high-level approach do the authors take, and why do they mention a decomposition scheme?

Section B. Problem framing (20 minutes)

Summarize in your own words (bullet points allowed):

- Tournament format
 - Number of teams and rounds
 - Single round robin structure
 - Each round spans 3–4 days, each team plays once per round
- Fixed calendar factors
 - Pre-fixed round dates to align with FIFA windows
- Geographic reality
 - Teams clustered in GBA vs. distant teams; travel up to ~3,300 km
- Stakeholders and motives

Write your name here_____.

- Clubs (sport fairness and revenues), broadcasters (ratings slots), government (public order), fans (rivalries)
- Core scheduling decision
 - For each pair of teams: which round, which venue, and assignment to date/time within the round

Section C. Fairness and constraints inventory (15 minutes)

Create two lists: measurable fairness goals and hard/soft constraints.

1) Candidate fairness metrics (quantify where possible)

- Travel fairness
 - Total travel distance per team (target: comparable among geographically similar teams; e.g., within X% among GBA clubs)
 - Variance or max-min gap of travel distances
- Venue alternation fairness
 - Avoid repeating the same venue for a pair across consecutive seasons; break legacy streaks
- Competitive balance
 - Limit sequences of strong opponents in a row (e.g., no more than k strong teams consecutively)
- Home/away balance
 - Avoid long streaks of home or away games (e.g., max 2 in a row)
- Revenue fairness
 - Ensure smaller clubs host at least one high-demand opponent
- Derby handling
 - Schedule high-risk rivalries thoughtfully (avoid same day as other high-risk games; ensure security capacity)

2) Hard constraints (must satisfy)

- Each team plays exactly once per round
- Single round robin: each pair plays exactly once; must choose the venue
- Stadium availability (blackout dates)
- Public order and security constraints for derbies/high-risk matches
- Broadcast non-overlap rules (if applicable) for marquee matches

3) Soft constraints (to optimize/penalize)

- Minimize total and disparity of travel distances
- Limit strong-opponent runs and home/away streaks
- Preferred time slots for broadcasters
- Avoidance of back-to-back long trips

Section D. Data you need (20 minutes)

List data inputs you must assemble:

- Teams, home stadium locations, distances between all pairs (or travel times)
- Strength tiers and rivalry flags
- Stadium availability calendar
- Pre-fixed round dates and time-slot grid

Write your name here_____.

- Broadcast rules: protected windows, marquee caps per day, non-overlap sets
- Government/security constraints: cannot co-schedule certain matches, derby timing rules
- Historical venue sequence for each pair (to detect legacy streaks to break)

Section E. Define objectives (10 minutes)

Select one or more objective functions. Write your chosen objective(s) clearly with a short explanation of weights or priority order.

Section F. Propose at least one scheduling method (30–40 minutes)

Prepare one or more methods. For each method, fill the template below

Method template

- 1) Method name
- 2) Intuition and why it fits this problem
- 3) Inputs (from Section D)
- 4) Decision variables (what you choose)
- 5) Objective(s) (from Section E)
- 6) Constraints (from Section C)
- 7) Algorithm outline or pseudocode
- 8) Expected strengths/weaknesses
- 9) How you will check feasibility and quality
- 10) Runtime and scalability expectations

Section G. Small pilot exercise (optional, 20–30 minutes)

Using 6 teams (A–F), 5 rounds, and a made-up distance matrix:

- Identify two clusters (e.g., {A,B,C} and {D,E,F})
- Propose a cluster pattern: each team takes two out-of-cluster trips, not back-to-back
- Build a 5-round pairing table fulfilling one match per team per round
- Assign venues to break any legacy streaks you invent (e.g., AB hosted by A last season)
- Compute approximate travel per team and report max-min gap

Section H. Validation plan (5–10 minutes)

Describe how you will evaluate a candidate schedule:

- Feasibility checklist: all hard constraints satisfied
- Fairness dashboard: travel totals, disparity, streak counts, legacy breaks achieved
- Stakeholder review: a list of matches requiring sign-off (derbies, marquee slots)
- Stress tests: remove a stadium on a given weekend; see if repairs are possible with limited swaps

Grading rubric (for self-check)

- Problem brief clearly captures stakeholders, goals, and constraints (20%)
- Fairness metrics and constraint list are concrete and measurable (20%)
- Proposed method(s) are complete: inputs, decisions, objectives, constraints, and algorithm outline (40%)
- Validation and trade-off discussion demonstrates practical awareness (20%)

→ Submit your report after 7 days of finishing this in-class activity
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Write your name here_____.

Phase 1 Worksheet: Deliverable Worksheet #1

“A one-page problem brief (your own words).”

Hint: To finish this task (#1), individual students should finish Section (A) and Section (B) sequentially. Collect your answers in Section (A) and (B) and these answers become the sentences in this 500-700 words one page report. Please use English for this part.

You can use the following blank area to draft your answers and report. 

Write your name here_____.

Phase 1 Worksheet: Deliverable Worksheet #2

“A structured list of fairness metrics and constraints you will use.” (As lengthy as you wish, no page limits)

Hint: To finish this task (#2), individual students should finish Section (C). You can use English and/or Chinese for this part. You do not need mathematical notations for this part, but if needed, a few math notations are acceptable.

You can use the following blank area to draft your answers and report. You can insert extra pages for this part as you wish. 

Write your name here_____.

Phase 1 Worksheet: Deliverable Worksheet #3

“Propose at least one complete method for sport scheduling, including data inputs, objective(s), constraints, and a solution approach (algorithmic plan).” (As lengthy as you wish, no page limits)

Hint: To finish this task (#3), individual students should finish Section (D)(E)(F) sequentially. You can use English and/or Chinese for this part. You should start to define necessary mathematical notations for this part. If necessary, some plans made in Section (C) can be modified and simplified.

You can use the following blank area to draft your answers and report. You can insert extra pages for this part as you wish. 

Write your name here_____.

Phase 1 Worksheet: Deliverable Worksheet #4

“A short plan to validate and iterate on a candidate schedule.”

Hint: To finish this task (#1), individual students should finish Section (G) and/or Section (H). Collect your answers in Section (G) and/or (H) and these answers become the sentences in this 500-700 words one page report. Please use English for this part.

You can use the following blank area to draft your answers and report. 