# Round Robin Scheduler Test Documentation

## Test Case Overview

This document outlines the test cases for the Round Robin Tournament Scheduler application, explaining the purpose and validation criteria for each test input file.

## Test Case 1: Basic Tournament Scheduling (input1.txt)

**Purpose**: Validate the basic functionality of the scheduler with standard inputs.

**Test Parameters**:

- Single round-robin tournament (1)
- 5 teams (TEAM A through TEAM E)
- 3 days
- Time window: 9:00 - 17:00
- 90-minute matches
- 2 venues available
- 90-minute rest period

**Expected Validation**:

- All 10 matches should be scheduled
- No team should play consecutive matches without a 90-minute rest period
- All matches should be scheduled within the 9:00-17:00 time window
- No venue should host overlapping matches
- Schedule should be optimized to use fewer days if possible

## Test Case 2: Increased Participant Count (input2.txt)

**Purpose**: Test the scheduler's ability to handle a larger number of participants.

**Test Parameters**:

- Single round-robin tournament (1)
- 7 teams (WARRIORS, GLADIATORS, NOMADS, PHANTOMS, HURRICANES, CYBERWOLVES, TITANS)
- 3 days
- Time window: 8:00 - 18:00

- 60-minute matches
- 3 venues available
- 60-minute rest period

**Expected Validation**:

- All 21 matches should be successfully scheduled
- Multiple venues should be used effectively to fit all matches

## Test Case 3: Constrained Time Window (input3.txt)

**Purpose**: Test the scheduler's behavior under tight time constraints.

**Test Parameters**:

- Single round-robin tournament (1)
- 5 teams (LIONS, EAGLES, PANTHERS, VIPERS, SHARKS)
- 2 days
- Time window: 10:00 - 12:00 (only 2 hours per day)
- 60-minute matches
- 2 venues available
- 30-minute rest period

**Expected Validation**:

- System should attempt to schedule matches within the limited time window
- In this case, no schedule is possible

## Test Case 4: Double Round-Robin (input4.txt)

**Purpose**: Validate the double round-robin functionality with a smaller participant group.

**Test Parameters**:

- Double round-robin tournament (2)
- 4 teams (ALPHA, BETA, GAMMA, DELTA)
- 3 days
- Time window: 9:00 - 17:00
- 90-minute matches
- 2 venues available
- 120-minute rest period (longer rest requirement)

**Expected Validation**:

- All 12 matches should be scheduled (each team plays against others twice)
- The longer rest period (120 minutes) should be respected
- Each team should play against every other team exactly twice
- The schedule should optimize venue usage

# Test Case 5: Double Round-Robin with Extended Group (input5.txt)

**Purpose**: Test the system's capacity for handling double round-robin with a larger number of participants.

**Test Parameters**:

- Double round-robin tournament (2)
- 5 teams (TEAM A through TEAM E)
- 3 days
- Time window: 9:00 - 17:00
- 90-minute matches
- 2 venues available
- 90-minute rest period

**Expected Validation**:

- All 20 matches should be scheduled (each team plays against others twice)
- The system should handle the increased number of matches efficiently
- May require thorough optimization to fit all matches within constraints
- Tests the backtracking algorithm's effectiveness with larger problem spaces

**Note:**

- Because the current scheduling algorithm is inefficient, the program stalls and does not print the schedule. We need to determine the upper limit of the number of matches that our program currently allows.

## Test Case 6: Error – Match Length Not Divisible by 30 (input6.txt)

**Purpose:** Ensure the scheduler rejects configurations where the match length isn't divisible by 30 minutes.

**Test Parameters:**

- **Tournament Type:** Single round robin (1)
- **Teams:** TEAM X, TEAM Y, TEAM Z
- **Days:** 1
- **Time Window:** 09:00 – 12:00 (180 minutes, divisible by 30)
- **Match Length:** 45 minutes (45 ÷ 30 = 1.5, invalid)
- **Venues:** 1 available
- **Rest Period:** 60 minutes (valid)

**Expected Validation:**

- The program should output: `Error: Match length, rest period, and tournament time must be divisible by 30 minutes.`

## Test Case 7: Standard Single Round Robin Tournament (input7.txt)

**Purpose:** Test a moderate scenario to ensure every team plays every other team exactly once.

**Test Parameters:**

- **Tournament Type:** Single round robin (1)
- **Teams:** (TEAM X, TEAM Y, TEAM Z, TEAM W, TEAM V)
- **Days:** 3
- **Time Window:** 09:00 - 17:00
- **Match Length:** 90 minutes
- **Venues:** 2 available
- **Rest Period:** 90 minutes

**Expected Validation:**

- A total of 10 matches should be scheduled (5 teams → 5×4/2 = 10).
- All matches must respect the rest period and time constraints.
- Venue usage should be balanced to optimize the schedule.

## Test Case 8: Double Round Robin with Larger Team Count (input8.txt)

**Purpose:** Validate that the scheduler handles a double round robin setup with more teams, ensuring that every pairing occurs twice.

**Test Parameters:**

- **Tournament Type:** Double round robin (2)
- **Teams:** (RED, BLUE, GREEN, YELLOW, ORANGE, PURPLE, BLACK, WHITE)
- **Days:** 5
- **Time Window:** 08:00 - 20:00
- **Match Length:** 60 minutes
- **Venues:** 3 available
- **Rest Period:** 30 minutes

**Expected Validation:**

- A total of 56 matches should be scheduled (8 teams: 2 × [8×7/2] = 56).
- Each team plays every other team exactly twice.
- The schedule must adhere to the match, rest, and venue constraints.

# Test Case 9: Error – Rest Period Not Divisible by 30 (input9.txt)

**Purpose:** Ensure the scheduler rejects configurations where the rest period isn't divisible by 30 minutes.

**Test Parameters:**

- **Tournament Type:** Single round robin (1)
- **Teams:** TEAM A, TEAM B, TEAM C
- **Days:** 1
- **Time Window:** 09:00 – 12:00 (180 minutes)
- **Match Length:** 90 minutes (valid)
- **Venues:** 1 available
- **Rest Period:** 45 minutes (45 ÷ 30 = 1.5, invalid)

**Expected Validation:**

- The program should output the same divisibility error regarding the rest period.

# Test Case 10: Error – Tournament Time Not Divisible by 30 (input10.txt)

**Purpose:** Verify that an error is thrown if the total tournament time (from start to end) isn't divisible by 30 minutes.

**Test Parameters:**

- **Tournament Type:** Single round robin (1)
- **Teams:** TEAM A, TEAM B
- **Days:** 1
- **Time Window:** 09:00 – 10:15 (75 minutes; 75 ÷ 30 = 2.5, invalid)
- **Match Length:** 30 minutes
- **Venues:** 1 available
- **Rest Period:** 30 minutes

**Expected Validation:**

- The program should output the same error regarding the tournament time.

# Test Case 11: Extended Tournament with Generous Resources (input11.txt)

**Purpose:** Ensure that the scheduler efficiently handles a larger tournament with ample time and multiple venues, allowing a more relaxed schedule.

**Test Parameters:**

- **Tournament Type:** Single round robin (1)
- **Teams:** (A, B, C, D, E, F, G, H, I, J)
- **Days:** 7
- **Time Window:** 07:00 - 22:00
- **Match Length:** 90 minutes
- **Venues:** 3 available
- **Rest Period:** 60 minutes

**Expected Validation:**

- A total of 45 matches should be scheduled (10 teams: 10×9/2 = 45).
- All matches must adhere to the match length, rest, and venue constraints.
- The schedule should be well-distributed across the 7 days.

# Test Case 12: Maximum Venues and Days (input12.txt)

**Purpose:** Stress-test the scheduler with the maximum allowed days and venues while ensuring all time-related values are divisible by 30.

**Test Parameters:**

- **Tournament Type:** Single round robin (1)
- **Teams:** TEAM1, TEAM2, TEAM3, TEAM4, TEAM5, TEAM6, TEAM7, TEAM8, TEAM9, TEAM10
- **Days:** 30 (maximum)
- **Time Window:** 08:00 – 20:00 (720 minutes; 720 ÷ 30 = 24)
- **Match Length:** 90 minutes
- **Venues:** 10 (maximum)
- **Rest Period:** 90 minutes

**Expected Validation:**

- For 10 teams in a single round robin, there will be 45 matches (which is below MAX_MATCHUPS).
- The scheduler should distribute matches efficiently over 30 days and 10 venues.

# Test Case 13: Maximum Duration & Rest Period Edge (input13.txt)

**Purpose:** Test scheduling when using the maximum allowed match length (300 minutes) and rest period (480 minutes) with a multi-day layout.

**Test Parameters:**

- **Tournament Type:** Single round robin (1)
- **Teams:** TEAM1, TEAM2, TEAM3, TEAM4
- **Days:** 10
- **Time Window:** 08:00 – 18:00 (600 minutes, divisible by 30)
- **Match Length:** 300 minutes (divisible by 30)
- **Venues:** 2 available
- **Rest Period:** 480 minutes (divisible by 30; note the extreme duration)

**Expected Validation:**

- Total matches = (4×3)/2 = 6.
- Because of the long match and rest durations, each team should play at most one match per day.
- The scheduler should distribute matches over different days to satisfy the constraints.

# Test Case 14: Maximum Valid Participants for Single Round Robin (input14.txt)

**Purpose:** Validate the scheduler with the largest number of participants that still keeps the total matchups under MAX_MATCHUPS. (For a single round robin, 14 teams yield 91 matches.)

**Test Parameters:**

- **Tournament Type:** Single round robin (1)
- **Teams:** TEAM1 through TEAM14
- **Days:** 5
- **Time Window:** 08:00 – 18:00 (600 minutes, divisible by 30)
- **Match Length:** 30 minutes
- **Venues:** 3 available
- **Rest Period:** 30 minutes

**Expected Validation:**

- Total matches = (14×13)/2 = 91.
- The schedule should be created without error and adhere to all divisibility rules.

# Test Case 15 : Minimum Participants Edge Case (input15.txt)

**Purpose:** Test scheduler behavior with the minimum allowed number of participants.

**Test Parameters:**

- **Tournament Type:** Single round robin (1)
- **Teams:** TEAM A, TEAM B
- **Days:** 1
- **Time Window:** 08:00 – 08:30 (30 minutes, divisible by 30)
- **Match Length:** 30 minutes
- **Venues:** 1 available
- **Rest Period:** 30 minutes

**Expected Validation:**

- Total matches = 1.
- The scheduler should create the schedule without any warnings or errors.

# Test Case 16: Extra Venue Slack Scenario (input16.txt)

**Purpose:** Test efficient match distribution when many venues are available, even if they're not all needed.

**Test Parameters:**

- **Tournament Type:** Single round robin (1)
- **Teams:** TEAM1, TEAM2, TEAM3, TEAM4, TEAM5
- **Days:** 2
- **Time Window:** 09:00 – 15:00 (360 minutes, divisible by 30)
- **Match Length:** 30 minutes
- **Venues:** 10 available (maximum)
- **Rest Period:** 30 minutes

**Expected Validation:**

- Total matches = (5×4)/2 = 10.
- The schedule should leverage the surplus of venues to possibly parallelize matches and ease the scheduling process.

# Test Case 17 : Extreme Tight Scheduling Leading to High Backtracking (input17.txt)

**Purpose:** Force the scheduler into a nearly impossible scenario to test whether it can handle reaching (or exceeding) the MAX_BACKTRACKS limit gracefully.

**Test Parameters:**

- **Tournament Type:** Single round robin (1)
- **Teams:** TEAM A, TEAM B, TEAM C, TEAM D, TEAM E, TEAM F
- **Days:** 1
- **Time Window:** 09:00 – 10:30 (90 minutes, divisible by 30)
- **Match Length:** 30 minutes
- **Venues:** 1 available
- **Rest Period:** 30 minutes

**Expected Validation:**

- Total matches = (6×5)/2 = 15 matches.
- With only 90 minutes available on one venue, it's impossible to schedule all matches.

- The scheduler should either report that no valid schedule exists or indicate that the MAX_BACKTRACKS limit was reached.

## Test Case 18: Single Round Robin, 4 Teams, Short Time Window (input18.txt)

**Purpose**: Test an edge case with a very short daily time window.

**Test Parameters**:

- **Tournament Type**: Single round robin (1)
- **Teams**: 4 teams (TEAM A, TEAM B, TEAM C, TEAM D)
- **Days**: 2
- **Time Window**: 10:00 – 11:00
- **Match Length**: 30 minutes
- **Venues**: 1 available
- **Rest Period**: 30 minutes

**Expected Validation**:

- Insufficient time: scheduler reports error.

## Test Case 19: Single Round Robin, 3 Teams, Non-Numeric Match Length (input19.txt)

**Purpose**: Test that non-numeric input for match length is rejected.

**Test Parameters**:

- **Tournament Type**: Single round robin (1)
- **Teams**: 3 teams (TEAM A, TEAM B, TEAM C)
- **Days**: 1
- **Time Window**: 09:00 – 12:00
- **Match Length**: “sixty” (non-numeric)
- **Venues**: 1 available
- **Rest Period**: 30 minutes

**Expected Validation**:

- Error: Match length must be numeric.

## Test Case 20: Single Round Robin, 3 Teams, Window Spanning Midnight (input20.txt)

**Purpose**: Verify proper handling when the time window spans midnight.

**Test Parameters**:

- **Tournament Type:** Single round robin (1)
- **Teams: 3 teams** (TEAM A, TEAM B, TEAM C)
- **Days:** 2
- **Time Window:** 23:00 – 01:00
- **Match Length:** 30 minutes
- **Venues:** 1 available
- **Rest Period:** 30 minutes

**Expected Validation**:

- **Error**: End time must be after start time.

## Test Case 21: Single Round Robin, 3 Teams, Extra Whitespace (input21.txt)

**Purpose**: Ensure that extra whitespace in the input is trimmed and does not affect scheduling.

**Test Parameters**:

- **Tournament Type:** Single round robin (1)
- **Teams: 3 teams** (TEAM A, TEAM B, TEAM C)
- **Days:** 1
- **Time Window:** " 09:00 " – " 12:00 "
- **Match Length:** 30 minutes
- **Venues:** 1 available
- **Rest Period:** 30 minutes

**Expected Validation**:

- Extra whitespace is trimmed; matches scheduled normally

## Test Case 22: Single Round Robin, 3 Teams, Mixed-Case, Spaced Names (input22.txt)

**Purpose**: Verify that team names differing only in case or spacing are treated as distinct.

**Test Parameters**:

- **Tournament Type:** Single round robin (1)
- **Teams:** 3 teams (Team A, teAmb, TEAM a)
- **Days:** 1
- **Time Window:** 09:00 – 11:00
- **Match Length:** 30 minutes
- **Venues:** 1 available
- **Rest Period:** 30 minutes

**Expected Validation**:

- Error: A schedule was not able to be generated based on the input

## Test Case 23: Single Round Robin, 2 Teams, Excessive Match Duration (input23.txt)

**Purpose**: Test error handling when the match duration exceeds the available time.

**Test Parameters**:

- **Tournament Type:** Single round robin (1)
- **Teams:** 2 teams (TEAM A, TEAM B)
- **Days:** 1
- **Time Window:** 09:00 – 10:00
- **Match Length:** 90 minutes (exceeds available time)
- **Venues:** 1 available
- **Rest Period:** 30 minutes

**Expected Validation**:

- Error: Invalid match length.

## Test Case 24: Four Round Robins, 4 Teams, Time and Days Sufficient (input24.txt)

**Purpose**: Evaluate scheduling for a four round robin tournament with 4 teams when days and time are sufficient.

**Test Parameters**:

- **Tournament Type:** 4
- **Teams:** 4 teams (TEAM A, TEAM B, TEAM C, TEAM D)
- **Days:** 3
- **Time Window:** 09:00 – 15:00 (360 minutes per day)
- **Match Length:** 30 minutes
- **Venues:** 1 available
- **Rest Period:** 30 minutes

**Expected Validation**:

- 24 matches scheduled successfully.

## Test Case 25: Five Round Robins, 5 Teams, Extended Time and Sufficient Days (input25.txt)

**Purpose**: Test scheduling for a five round robin tournament with 5 teams using an extended time window and enough days.

**Test Parameters**:

- **Tournament Type:** 5
- **Teams:** 5 teams (TEAM A, TEAM B, TEAM C, TEAM D, TEAM E)
- **Days:** 4
- **Time Window:** 08:00 – 18:00 (600 minutes per day)
- **Match Length:** 30 minutes
- **Venues:** 1 available
- **Rest Period:** 30 minutes

**Expected Validation**:

- 50 matches scheduled successfully.

## Test Case 26: Five Round Robins, 3 Teams, Insufficient Days with Long Match Length (input26.txt)

**Purpose**: Demonstrate that even with the minimum number of teams, if the match length is increased, a five round robin tournament can fail due to too few available days.

**Test Parameters**:

- **Tournament Type:** 5 (five round robins)
- **Teams:** 3 teams (TEAM A, TEAM B, TEAM C)
- **Days:** 1
- **Time Window:** 09:00 – 12:00 (180 minutes per day)
- **Match Length:** 60 minutes
- **Venues:** 1 available
- **Rest Period:** 30 minutes

**Expected Validation**:

- Insufficient overall time/days to schedule 15 matches.

## Test Case 27: Four Round Robins, 4 Teams, Sufficient Days with Short Match Length (input27.txt)

**Purpose**: Demonstrate that even with the minimum number of teams, if the match length is increased, a five round robin tournament can fail due to too few available days.

**Test Parameters**:

- **Tournament Type:** Four round robins (4)
- **Teams:** 4 teams (TEAM A, TEAM B, TEAM C, TEAM D)
- **Days:** 2
- **Time Window:** 09:00 – 16:00 (7 hours = 420 minutes per day)
- **Match Length:** 30 minutes
- **Venues:** 1 available
- **Rest Period:** 30 minutes

**Expected Validation**:

- Insufficient overall time/days to schedule 24 matches.