# The Aircraft Rotation Problem

Aircraft Rotation is a major problem faced by any existing airline company. The problem arises after schedule design and fleet assignment have been dealt with. The aim of the Aircraft Rotation Problem (ARP) is to feasibly combine successive flight legs into streams of flights that are capable of being operated by individual aircrafts.

Flight streams must satisfy a number of pre-defined operational constraints and should number, in principle, less than the number of available aircrafts. Rotations are typically generated for a week and are then extended for longer periods of time.

## Objective Function

The main objective function goal is to minimize the number of aircraft necessary to operate the flight schedule. However, if the number of aircraft available is fixed in advance and is passed as an input data to the system, we aim at maximizing the number of flights the fleet could possibly fly.

Either way, as an additional optimization goal, our system attempts to maximize the number of possible journeys a passenger could carry out, in a single day, between any given pair of destinations, i.e. it aims at optimizing the number of possible connections.

## Temporal and Geographic Constraints

Flights are allowed to be linked together if they do not violate certain operational constraints. Constraints are geographical and temporal in nature. For instance, the next flight leg in a rotation must have the same departure location as the arrival location for the previous flight leg. Additionally, the amount of time spent between consecutive flight legs must fall within a given time window, that allows for a minimal connection time or ground connection time.

## Crew Pairing Constraints

Various constraints related to the Crew Pairing Problem do exist. However, some of them must already be enforced throughout the aircraft rotation process. These constraints are associated with the ground time allowed between consecutive flight legs to be performed by a same aircraft. Crew members are not allowed more than a given pre-defined number of consecutive landings, say 5 or 6, and crews must be changed before that limit is exceeded. Thus, enough ground time (say 40 minutes) must be allowed between at least two consecutive flight legs in a sequence of 5 or 6 consecutive flight legs.

## Flight Number Constraint

Some flight legs are commonly labeled with a single flight number, which identifies an indivisible flight structure. This unique structure is created to guarantee that its flight legs will be operated by a same aircraft and, as such, passengers will be able to fly these legs without changing planes.

## Special Flight Operations

These constraints are related to the requirement that some specific flights must be operated by some special aircraft and apply even for aircraft within a same fleet. For instance, some aircraft must be configured to make special landings and takeoffs, such as those carried out at Santos Dumont Airport (SDU), in the city of Rio de Janeiro. These aircraft must have special engines capable of delivering greater power during takeoff, and are suitable for airports having reduced runway lengths, as SDU. Thus, the number of aircraft to be assigned to flight legs departing from or/and taking off from these airports must be in accordance with this constraint. Cabin crew (specifically pilots and copilots) may also need special training to perform these assignments for working under these conditions. Thus a concentration of particular aircraft and cabin crew naturally follows from these requirements.

## Aircraft Maintenance

Rotations are supposed to be assigned to non-specific aircraft. This way, if a maintenance planner must stop a given aircraft at a certain specific location, a dummy flight departing and arriving at that location must be created and added to the set of flight legs to be operated by the aircraft. Finally, this maintenance

rotation should then be assigned to the specifically desired aircraft, during daily operations.

## DATA AND PARAMETERS

### The Flight Schedule

You may send your flight schedule in two different formats: as flights patterns (SSIM File) or daily flights format. If you choose sending a SSIM File, you must specify the time period you want daily flights to be generated, and fleet to be processed.

### Transit Time

There must be a sufficient time for ground operations between two flight legs. It may vary from one airport to another, so the minimal time for each airport involved must be sent to the problem. You will be able to admit a marginal adjust in flight departure, for instance, 5 minutes, in order to investigate solutions that can produce better results. In this case, this acceptance and how much time is admitted must be informed as parameters.

### Crew Replacement Time

There also must be a sufficient time for crew changes after a certain number os landings in a row. This is required for crew arriving and departing procedures, and it may be estimated as a unique time for all airports, something about 40 minutes, after 5 landings, are usually estimated as sufficient time for those procedures.

### Ferry Flights

You must indicate if you accept that system may suggest ferry flights between two near airports, in order to reduce the necessary number of required aircraft. If you do, you may establish limits of flight time for those positioning flights.

### Flight Number Constraint

Some flight legs are commonly labeled with a single flight number, which identifies an indivisible flight structure. This unique flight numeration is created in

order to guarantee that all flight legs will be assigned to the same aircraft, and doing so, passengers will be able to fly all those legs without changing planes.

## Passenger Connections

Relating to maximizing connections between pairs of airports, there must be informed to the system parameters that configure a trip as acceptable for passengers during a single day, as: maximum time flight, maximum number of aircraft changes, maximum time of waiting at an airport between two flight legs, during an aircraft change.

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CASE STUDY (A SINGLE EXAMPLE)

Data and parameters for system submission must be sent by e-mail. Here goes an
example:

----- Mail Example ---------------------------------------------------------------
From:        Example Airlines
TO:          rpontesbr@yahoo.com.br
Subject:     Crew Scheduling


Attach:           SSIM File
_____


Responsible       John Brown
Company           Airlines Example
E-mail            example@example.com.br

DAILY FLIGHTS GENERATION   (When sending SSIM Files)

      SCHEDULE BEGINNING                    [2007 June, 1st]
      SCHEDULE ENDING                       [2007 June, 1st]
      FLEET                                 [B73G] [B73S] [B733]

NUMBER OF AIRCRAFT                          [Minimize]

TRANSIT TIME

      Default                               [20] minutes
      SDU, CGH, BSB                         [25] minutes
      FLN, PLU                              [15] minutes

CHANGING CREW TIME DEFAULT                  [30] minutes

FERRY FLIGHTS ACCEPTANCE                    [N]

BRAKING FLIGHT STRUCTURE ACCEPTANCE         [N]
CHANGING FLIGHT TIME DEPARTURE ACCEPTANCE   [N]

PASSENGER TRIP PARAMETERS

      MAX FLIGHT TIME                       [720 min]
      MAX AIRCRAFT CHANGES:                 [1]
      MAX TIME WAITING CONNECTIONS:         [240 min]
```

MIANTENANCE

[BSB]         2007/06/01 14:00     TO     2007/06/01 20:00

**GENERATED DAILY FLIGHTS**

| SEQ | FLIGHT | LEG | FROM | TO | DEPARTURE | ARRIVAL |
|---|---|---|---|---|---|---|
| 1 | 2201 | 1 | CGR | CGH | 2007/06/01 05:00 | 2007/06/01 06:13 |
| 2 | 2197 | 1 | FOR | REC | 2007/06/01 06:00 | 2007/06/01 07:10 |
| 3 | 2286 | 1 | CPQ | SDU | 2007/06/01 06:10 | 2007/06/01 07:10 |
| 4 | 2133 | 1 | SDU | CGH | 2007/06/01 06:20 | 2007/06/01 07:20 |
| 5 | 2220 | 1 | POA | CWB | 2007/06/01 06:20 | 2007/06/01 07:20 |
| 6 | 2109 | 1 | VIX | PLU | 2007/06/01 06:25 | 2007/06/01 07:14 |
| 7 | 2224 | 1 | MGF | CWB | 2007/06/01 06:30 | 2007/06/01 07:20 |
| 8 | 2315 | 1 | FOR | BSB | 2007/06/01 06:40 | 2007/06/01 08:56 |
| 9 | 2217 | 1 | REC | BSB | 2007/06/01 06:40 | 2007/06/01 09:13 |
| 10 | 2120 | 1 | CGH | SDU | 2007/06/01 06:51 | 2007/06/01 07:42 |
| 11 | 2327 | 1 | BSB | CGH | 2007/06/01 06:56 | 2007/06/01 08:30 |
| 12 | 2202 | 1 | CGH | PLU | 2007/06/01 06:58 | 2007/06/01 08:20 |
| 13 | 2203 | 1 | PLU | SDU | 2007/06/01 07:00 | 2007/06/01 08:00 |
| 14 | 2333 | 1 | GIG | CWB | 2007/06/01 07:00 | 2007/06/01 08:20 |
| 15 | 2334 | 1 | POA | CWB | 2007/06/01 07:20 | 2007/06/01 08:20 |
| 16 | 2100 | 1 | FLN | CGH | 2007/06/01 07:26 | 2007/06/01 08:27 |
| 17 | 2109 | 2 | PLU | CGH | 2007/06/01 07:30 | 2007/06/01 08:25 |
| 18 | 2197 | 2 | REC | SSA | 2007/06/01 07:30 | 2007/06/01 08:40 |
| 19 | 2286 | 2 | SDU | BSB | 2007/06/01 07:31 | 2007/06/01 08:56 |
| 20 | 2251 | 1 | BSB | GYN | 2007/06/01 07:40 | 2007/06/01 08:10 |
| 21 | 2224 | 2 | CWB | CPQ | 2007/06/01 07:40 | 2007/06/01 08:25 |
| 22 | 2112 | 1 | NVT | CGH | 2007/06/01 07:40 | 2007/06/01 08:37 |
| 23 | 2220 | 2 | CWB | CGH | 2007/06/01 07:40 | 2007/06/01 08:40 |
| 24 | 2134 | 1 | CGH | SDU | 2007/06/01 07:46 | 2007/06/01 08:47 |
| 25 | 2121 | 1 | SDU | CGH | 2007/06/01 08:00 | 2007/06/01 08:51 |
| 26 | 2192 | 1 | SDU | PLU | 2007/06/01 08:30 | 2007/06/01 09:29 |
| 27 | 2251 | 2 | GYN | CGH | 2007/06/01 08:30 | 2007/06/01 09:57 |
| 28 | 2202 | 2 | PLU | SSA | 2007/06/01 08:35 | 2007/06/01 10:05 |
| 29 | 2224 | 3 | CPQ | SDU | 2007/06/01 08:40 | 2007/06/01 09:40 |
| 30 | 2333 | 2 | CWB | POA | 2007/06/01 08:40 | 2007/06/01 09:40 |
| 31 | 2334 | 2 | CWB | GIG | 2007/06/01 08:40 | 2007/06/01 10:00 |
| 32 | 2135 | 1 | SDU | CGH | 2007/06/01 09:00 | 2007/06/01 10:07 |
| 33 | 2197 | 3 | SSA | GIG | 2007/06/01 09:00 | 2007/06/01 11:00 |
| 34 | 2327 | 2 | CGH | FLN | 2007/06/01 09:02 | 2007/06/01 09:55 |
| 35 | 2100 | 2 | CGH | GIG | 2007/06/01 09:05 | 2007/06/01 10:05 |
| 36 | 2112 | 2 | CGH | BSB | 2007/06/01 09:07 | 2007/06/01 10:30 |
| 37 | 2206 | 1 | CGH | PLU | 2007/06/01 09:09 | 2007/06/01 10:20 |
| 38 | 2101 | 1 | CGH | CWB | 2007/06/01 09:12 | 2007/06/01 10:00 |
| 39 | 2122 | 1 | CGH | SDU | 2007/06/01 09:21 | 2007/06/01 10:11 |
| 40 | 2261 | 1 | BSB | SDU | 2007/06/01 09:40 | 2007/06/01 11:10 |
| 41 | 2315 | 2 | BSB | CGH | 2007/06/01 09:42 | 2007/06/01 11:09 |
| 42 | 2198 | 1 | PLU | BSB | 2007/06/01 09:44 | 2007/06/01 11:08 |
| 43 | 2224 | 4 | SDU | VIX | 2007/06/01 10:00 | 2007/06/01 11:00 |
| 44 | 2336 | 1 | POA | CWB | 2007/06/01 10:00 | 2007/06/01 11:00 |
| 45 | 2327 | 3 | FLN | POA | 2007/06/01 10:10 | 2007/06/01 11:00 |
| 46 | 2256 | 1 | CGH | NVT | 2007/06/01 10:24 | 2007/06/01 11:20 |
| 47 | 2123 | 1 | SDU | CGH | 2007/06/01 10:28 | 2007/06/01 11:28 |
| 48 | 2136 | 1 | CGH | SDU | 2007/06/01 10:29 | 2007/06/01 11:29 |
| 49 | 2242 | 1 | CWB | CGH | 2007/06/01 10:30 | 2007/06/01 11:18 |
| 50 | 2202 | 3 | SSA | REC | 2007/06/01 10:30 | 2007/06/01 11:40 |
| 51 | 2334 | 3 | GIG | BSB | 2007/06/01 10:30 | 2007/06/01 12:00 |
| 52 | 2100 | 3 | GIG | SSA | 2007/06/01 10:30 | 2007/06/01 12:29 |

| 53  | 2207 | 1 | PLU | CGH | 2007/06/01 10:35 | 2007/06/01 11:46 |
|-----|------|---|-----|-----|------------------|------------------|
| 54  | 2189 | 1 | BSB | PLU | 2007/06/01 10:57 | 2007/06/01 12:08 |
| 55  | 2261 | 2 | SDU | CGH | 2007/06/01 11:30 | 2007/06/01 12:29 |
| 56  | 2194 | 1 | VIX | SDU | 2007/06/01 11:20 | 2007/06/01 12:20 |
| 57  | 2336 | 2 | CWB | BSB | 2007/06/01 11:20 | 2007/06/01 13:09 |
| 58  | 2102 | 1 | POA | FLN | 2007/06/01 11:30 | 2007/06/01 12:20 |
| 59  | 2197 | 4 | GIG | CGH | 2007/06/01 11:30 | 2007/06/01 12:26 |
| 60  | 2236 | 1 | CGH | CGR | 2007/06/01 11:45 | 2007/06/01 13:14 |
| 61  | 2242 | 2 | CGH | BSB | 2007/06/01 11:50 | 2007/06/01 13:20 |
| 62  | 2202 | 4 | REC | FOR | 2007/06/01 12:00 | 2007/06/01 13:10 |
| 63  | 2124 | 1 | CGH | SDU | 2007/06/01 12:01 | 2007/06/01 13:01 |
| 64  | 2208 | 1 | CGH | PLU | 2007/06/01 12:05 | 2007/06/01 13:09 |
| 65  | 2291 | 1 | BSB | CGH | 2007/06/01 12:20 | 2007/06/01 14:00 |
| 66  | 2189 | 2 | PLU | VIX | 2007/06/01 12:28 | 2007/06/01 13:18 |
| 67  | 2334 | 4 | BSB | FOR | 2007/06/01 12:30 | 2007/06/01 15:00 |
| 68  | 2102 | 2 | FLN | CGH | 2007/06/01 12:40 | 2007/06/01 13:32 |
| 69  | 2194 | 2 | SDU | BSB | 2007/06/01 12:40 | 2007/06/01 14:10 |
| 70  | 2180 | 1 | CGH | POA | 2007/06/01 12:51 | 2007/06/01 14:20 |
| 71  | 2261 | 3 | CGH | CWB | 2007/06/01 12:59 | 2007/06/01 13:40 |
| 72  | 2125 | 1 | SDU | CGH | 2007/06/01 13:26 | 2007/06/01 14:23 |
| 73  | 2223 | 1 | PLU | CGH | 2007/06/01 13:26 | 2007/06/01 14:31 |
| 74  | 2191 | 1 | VIX | SDU | 2007/06/01 13:40 | 2007/06/01 14:40 |
| 75  | 2242 | 3 | BSB | SSA | 2007/06/01 13:50 | 2007/06/01 15:50 |
| 76  | 2261 | 4 | CWB | MGF | 2007/06/01 14:00 | 2007/06/01 14:50 |
| 77  | 9999 | 1 | BSB | BSB | 2007/06/01 14:00 | 2007/06/01 20:00 |
| 78  | 2102 | 3 | CGH | GIG | 2007/06/01 14:02 | 2007/06/01 15:00 |
| 79  | 2139 | 1 | SDU | CGH | 2007/06/01 14:26 | 2007/06/01 15:20 |
| 80  | 2291 | 2 | CGH | CWB | 2007/06/01 14:30 | 2007/06/01 15:20 |
| 81  | 2126 | 1 | CGH | SDU | 2007/06/01 14:50 | 2007/06/01 15:40 |
| 82  | 2193 | 1 | BSB | SDU | 2007/06/01 14:50 | 2007/06/01 16:20 |
| 83  | 2210 | 1 | CGH | PLU | 2007/06/01 14:52 | 2007/06/01 15:57 |
| 84  | 2190 | 1 | SDU | VIX | 2007/06/01 15:00 | 2007/06/01 15:50 |
| 85  | 2257 | 1 | NVT | CGH | 2007/06/01 15:05 | 2007/06/01 16:06 |
| 86  | 2262 | 1 | MGF | CWB | 2007/06/01 15:10 | 2007/06/01 16:00 |
| 87  | 2102 | 4 | GIG | SSA | 2007/06/01 15:30 | 2007/06/01 17:25 |
| 88  | 2335 | 1 | FOR | BSB | 2007/06/01 15:30 | 2007/06/01 18:10 |
| 89  | 2291 | 3 | CWB | POA | 2007/06/01 15:40 | 2007/06/01 16:40 |
| 90  | 2211 | 1 | FOR | REC | 2007/06/01 15:50 | 2007/06/01 17:00 |
| 91  | 2140 | 1 | CGH | SDU | 2007/06/01 15:52 | 2007/06/01 16:59 |
| 92  | 2337 | 1 | BSB | CWB | 2007/06/01 15:54 | 2007/06/01 17:40 |
| 93  | 2127 | 1 | SDU | CGH | 2007/06/01 15:55 | 2007/06/01 16:45 |
| 94  | 2285 | 1 | SSA | GIG | 2007/06/01 16:00 | 2007/06/01 17:59 |
| 95  | 2119 | 1 | VIX | PLU | 2007/06/01 16:10 | 2007/06/01 17:00 |
| 96  | 2302 | 1 | PLU | BSB | 2007/06/01 16:12 | 2007/06/01 17:25 |
| 97  | 2262 | 2 | CWB | CGH | 2007/06/01 16:20 | 2007/06/01 17:11 |
| 98  | 2243 | 1 | SSA | BSB | 2007/06/01 16:20 | 2007/06/01 18:08 |
| 99  | 2237 | 1 | CGR | CGH | 2007/06/01 16:30 | 2007/06/01 18:03 |
| 100 | 2260 | 1 | CGH | SDU | 2007/06/01 16:31 | 2007/06/01 17:21 |
| 101 | 2330 | 1 | CGH | GIG | 2007/06/01 16:32 | 2007/06/01 17:35 |
| 102 | 2193 | 2 | SDU | VIX | 2007/06/01 16:40 | 2007/06/01 17:40 |
| 103 | 2103 | 1 | CGH | FLN | 2007/06/01 17:10 | 2007/06/01 18:05 |
| 104 | 2290 | 1 | POA | CWB | 2007/06/01 17:10 | 2007/06/01 18:10 |
| 105 | 2119 | 2 | PLU | CGH | 2007/06/01 17:15 | 2007/06/01 18:15 |
| 106 | 2141 | 1 | SDU | CGH | 2007/06/01 17:19 | 2007/06/01 18:09 |
| 107 | 2128 | 1 | CGH | SDU | 2007/06/01 17:29 | 2007/06/01 18:29 |
| 108 | 2211 | 2 | REC | SSA | 2007/06/01 17:30 | 2007/06/01 18:40 |
| 109 | 2260 | 2 | SDU | BSB | 2007/06/01 17:41 | 2007/06/01 19:08 |
| 110 | 2105 | 1 | SSA | GIG | 2007/06/01 17:50 | 2007/06/01 19:39 |
| 111 | 2235 | 1 | VIX | SDU | 2007/06/01 18:00 | 2007/06/01 19:00 |
| 112 | 2337 | 2 | CWB | POA | 2007/06/01 18:00 | 2007/06/01 19:00 |
| 113 | 2330 | 2 | GIG | SSA | 2007/06/01 18:00 | 2007/06/01 19:50 |
| 114 | 2303 | 1 | BSB | PLU | 2007/06/01 18:10 | 2007/06/01 19:19 |
| 115 | 2103 | 2 | FLN | POA | 2007/06/01 18:20 | 2007/06/01 19:10 |

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116    2290    2    CWB    CGH    2007/06/01 18:30    2007/06/01 19:19
117    2285    2    GIG    CGH    2007/06/01 18:30    2007/06/01 19:27
118    2243    2    BSB    CGH    2007/06/01 18:38    2007/06/01 20:10
119    2335    2    BSB    GIG    2007/06/01 18:40    2007/06/01 20:10
120    2142    1    CGH    SDU    2007/06/01 18:43    2007/06/01 19:42
121    2129    1    SDU    CGH    2007/06/01 18:45    2007/06/01 19:44
122    2252    1    CGH    GYN    2007/06/01 18:47    2007/06/01 20:20
123    2314    1    CGH    BSB    2007/06/01 18:49    2007/06/01 20:19
124    2211    3    SSA    PLU    2007/06/01 19:00    2007/06/01 20:31
125    2104    1    POA    FLN    2007/06/01 19:20    2007/06/01 20:10
126    2235    2    SDU    CPQ    2007/06/01 19:20    2007/06/01 20:20
127    2332    1    POA    CWB    2007/06/01 19:30    2007/06/01 20:30
128    2233    1    PLU    SDU    2007/06/01 19:36    2007/06/01 20:29
129    2287    1    BSB    SDU    2007/06/01 19:41    2007/06/01 21:10
130    2143    1    SDU    CGH    2007/06/01 20:00    2007/06/01 20:48
131    2230    1    CGH    PLU    2007/06/01 20:00    2007/06/01 21:00
132    2326    1    CGH    BSB    2007/06/01 20:06    2007/06/01 21:41
133    2105    2    GIG    CGH    2007/06/01 20:10    2007/06/01 21:15
134    2330    3    SSA    REC    2007/06/01 20:10    2007/06/01 21:25
135    2130    1    CGH    SDU    2007/06/01 20:13    2007/06/01 20:52
136    2104    2    FLN    CGH    2007/06/01 20:30    2007/06/01 21:29
137    2252    2    GYN    BSB    2007/06/01 20:40    2007/06/01 21:10
138    2235    3    CPQ    CWB    2007/06/01 20:40    2007/06/01 21:25
139    2335    3    GIG    CWB    2007/06/01 20:40    2007/06/01 22:00
140    2232    1    SDU    PLU    2007/06/01 20:45    2007/06/01 21:40
141    2211    4    PLU    CGH    2007/06/01 20:46    2007/06/01 22:02
142    2243    3    CGH    CWB    2007/06/01 20:47    2007/06/01 21:30
143    2314    2    BSB    FOR    2007/06/01 20:49    2007/06/01 23:21
144    2332    2    CWB    GIG    2007/06/01 20:50    2007/06/01 22:10
145    2216    1    BSB    REC    2007/06/01 20:53    2007/06/01 23:30
146    2144    1    CGH    SDU    2007/06/01 21:14    2007/06/01 22:04
147    2131    1    SDU    CGH    2007/06/01 21:16    2007/06/01 22:09
148    2230    2    PLU    VIX    2007/06/01 21:22    2007/06/01 22:10
149    2287    2    SDU    CPQ    2007/06/01 21:32    2007/06/01 22:32
150    2330    4    REC    FOR    2007/06/01 21:45    2007/06/01 23:00
151    2105    3    CGH    FLN    2007/06/01 21:46    2007/06/01 22:39
152    2235    4    CWB    MGF    2007/06/01 21:50    2007/06/01 22:40
153    2243    4    CWB    POA    2007/06/01 21:50    2007/06/01 22:50
154    2335    4    CWB    POA    2007/06/01 22:20    2007/06/01 23:20
155    2200    1    CGH    CGR    2007/06/01 22:27    2007/06/01 23:55
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(Obs: Flight 77  is a dummy flight representing a maitenance at BSB).


**AIRCRAFT ROTATION SOLUTION 1**

**No ferry flights, no flight breaking struture, no deaprt time changes    (21 aircraft)**

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- AIRCRAFT 01 ─────────────────────────────────────
01    2201    1    CGR    CGH    05:00   06:13
02    2120    1    CGH    SDU    06:51   07:42
03    2192    1    SDU    PLU    08:30   09:29
04    2198    1    PLU    BSB    09:44   11:08
05    2291    1    BSB    CGH    12:20   14:00
06    2291    2    CGH    CWB    14:30   15:20
07    2291    3    CWB    POA    15:40   16:40
08    2290    1    POA    CWB    17:10   18:10
09    2290    2    CWB    CGH    18:30   19:19
10    2230    1    CGH    PLU    20:00   21:00
11    2230    2    PLU    VIX    21:22   22:10
- AIRCRAFT 02 ─────────────────────────────────────
01    2220    1    POA    CWB    06:20   07:20
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02    2220   2     CWB   CGH   07:40   08:40
03    2122   1     CGH   SDU   09:21   10:11
04    2190   1     SDU   VIX   15:00   15:50
05    2119   1     VIX   PLU   16:10   17:00
06    2119   2     PLU   CGH   17:15   18:15
07    2314   1     CGH   BSB   18:49   20:19
08    2314   2     BSB   FOR   20:49   23:21
─ AIRCRAFT 03 ─────────────────────────────
01    2202   1     CGH   PLU   06:58   08:20
02    2202   2     PLU   SSA   08:35   10:05
03    2202   3     SSA   REC   10:30   11:40
04    2202   4     REC   FOR   12:00   13:10
05    2335   1     FOR   BSB   15:30   18:10
06    2335   2     BSB   GIG   18:40   20:10
07    2335   3     GIG   CWB   20:40   22:00
08    2335   4     CWB   POA   22:20   23:20
─ AIRCRAFT 04 ─────────────────────────────
01    2112   1     NVT   CGH   07:40   08:37
02    2112   2     CGH   BSB   09:07   10:30
03    2337   1     BSB   CWB   15:54   17:40
04    2337   2     CWB   POA   18:00   19:00
─ AIRCRAFT 05 ─────────────────────────────
01    2286   1     CPQ   SDU   06:10   07:10
02    2286   2     SDU   BSB   07:31   08:56
03    2261   1     BSB   SDU   09:40   11:10
04    2261   2     SDU   CGH   11:30   12:29
05    2261   3     CGH   CWB   12:59   13:40
06    2261   4     CWB   MGF   14:00   14:50
07    2262   1     MGF   CWB   15:10   16:00
08    2262   2     CWB   CGH   16:20   17:11
09    2142   1     CGH   SDU   18:43   19:42
10    2232   1     SDU   PLU   20:45   21:40
─ AIRCRAFT 06 ─────────────────────────────
01    2224   1     MGF   CWB   06:30   07:20
02    2224   2     CWB   CPQ   07:40   08:25
03    2224   3     CPQ   SDU   08:40   09:40
04    2224   4     SDU   VIX   10:00   11:00
05    2191   1     VIX   SDU   13:40   14:40
06    2127   1     SDU   CGH   15:55   16:45
07    2103   1     CGH   FLN   17:10   18:05
08    2103   2     FLN   POA   18:20   19:10
09    2332   1     POA   CWB   19:30   20:30
10    2332   2     CWB   GIG   20:50   22:10
─ AIRCRAFT 07 ─────────────────────────────
01    2327   1     BSB   CGH   06:56   08:30
02    2327   2     CGH   FLN   09:02   09:55
03    2327   3     FLN   POA   10:10   11:00
04    2102   1     POA   FLN   11:30   12:20
05    2102   2     FLN   CGH   12:40   13:32
06    2102   3     CGH   GIG   14:02   15:00
07    2102   4     GIG   SSA   15:30   17:25
08    2105   1     SSA   GIG   17:50   19:39
09    2105   2     GIG   CGH   20:10   21:15
10    2105   3     CGH   FLN   21:46   22:39
─ AIRCRAFT 08 ─────────────────────────────
01    2133   1     SDU   CGH   06:20   07:20
02    2134   1     CGH   SDU   07:46   08:47
03    2123   1     SDU   CGH   10:28   11:28
04    2124   1     CGH   SDU   12:01   13:01
05    2139   1     SDU   CGH   14:26   15:20
06    2140   1     CGH   SDU   15:52   16:59
07    2141   1     SDU   CGH   17:19   18:09
08    2252   1     CGH   GYN   18:47   20:20
```

```
09    2252    2    GYN    BSB    20:40  21:10
- AIRCRAFT 09 ─────────────────────────────────
01    2334    1    POA    CWB    07:20  08:20
02    2334    2    CWB    GIG    08:40  10:00
03    2334    3    GIG    BSB    10:30  12:00
04    2334    4    BSB    FOR    12:30  15:00
05    2211    1    FOR    REC    15:50  17:00
06    2211    2    REC    SSA    17:30  18:40
07    2211    3    SSA    PLU    19:00  20:31
08    2211    4    PLU    CGH    20:46  22:02
09    2200    1    CGH    CGR    22:27  23:55
- AIRCRAFT 10 ─────────────────────────────────
01    2315    1    FOR    BSB    06:40  08:56
02    2315    2    BSB    CGH    09:42  11:09
03    2236    1    CGH    CGR    11:45  13:14
04    2237    1    CGR    CGH    16:30  18:03
05    2326    1    CGH    BSB    20:06  21:41
- AIRCRAFT 11 ─────────────────────────────────
01    2194    1    VIX    SDU    11:20  12:20
02    2194    2    SDU    BSB    12:40  14:10
03    2193    1    BSB    SDU    14:50  16:20
04    2193    2    SDU    VIX    16:40  17:40
- AIRCRAFT 12 ─────────────────────────────────
01    2203    1    PLU    SDU    07:00  08:00
02    2135    1    SDU    CGH    09:00  10:07
03    2208    1    CGH    PLU    12:05  13:09
04    2223    1    PLU    CGH    13:26  14:31
05    2260    1    CGH    SDU    16:31  17:21
06    2260    2    SDU    BSB    17:41  19:08
07    2287    1    BSB    SDU    19:41  21:10
08    2287    2    SDU    CPQ    21:32  22:32
- AIRCRAFT 13 ─────────────────────────────────
01    2251    1    BSB    GYN    07:40  08:10
02    2251    2    GYN    CGH    08:30  09:57
03    2256    1    CGH    NVT    10:24  11:20
04    2257    1    NVT    CGH    15:05  16:06
05    2330    1    CGH    GIG    16:32  17:35
06    2330    2    GIG    SSA    18:00  19:50
07    2330    3    SSA    REC    20:10  21:25
08    2330    4    REC    FOR    21:45  23:00
- AIRCRAFT 14 ─────────────────────────────────
01    2121    1    SDU    CGH    08:00  08:51
02    2136    1    CGH    SDU    10:29  11:29
03    2125    1    SDU    CGH    13:26  14:23
04    2210    1    CGH    PLU    14:52  15:57
05    2302    1    PLU    BSB    16:12  17:25
06    2303    1    BSB    PLU    18:10  19:19
07    2233    1    PLU    SDU    19:36  20:29
08    2131    1    SDU    CGH    21:16  22:09
- AIRCRAFT 15 ─────────────────────────────────
01    2109    1    VIX    PLU    06:25  07:14
02    2109    2    PLU    CGH    07:30  08:25
03    2206    1    CGH    PLU    09:09  10:20
04    2207    1    PLU    CGH    10:35  11:46
05    2126    1    CGH    SDU    14:50  15:40
06    2129    1    SDU    CGH    18:45  19:44
07    2130    1    CGH    SDU    20:13  20:52
- AIRCRAFT 16 ─────────────────────────────────
01    2197    1    FOR    REC    06:00  07:10
02    2197    2    REC    SSA    07:30  08:40
03    2197    3    SSA    GIG    09:00  11:00
04    2197    4    GIG    CGH    11:30  12:26
05    2180    1    CGH    POA    12:51  14:20
```

```
06      2104    1       POA     FLN     19:20   20:10
07      2104    2       FLN     CGH     20:30   21:29
- AIRCRAFT 17 ─────────────────────────────────
01      2217    1       REC     BSB     06:40   09:13
02      2189    1       BSB     PLU     10:57   12:08
03      2189    2       PLU     VIX     12:28   13:18
04      2235    1       VIX     SDU     18:00   19:00
05      2235    2       SDU     CPQ     19:20   20:20
06      2235    3       CPQ     CWB     20:40   21:25
07      2235    4       CWB     MGF     21:50   22:40
- AIRCRAFT 18 ─────────────────────────────────
01      2101    1       CGH     CWB     09:12   10:00
02      2242    1       CWB     CGH     10:30   11:18
03      2242    2       CGH     BSB     11:50   13:20
04      2242    3       BSB     SSA     13:50   15:50
05      2243    1       SSA     BSB     16:20   18:08
06      2243    2       BSB     CGH     18:38   20:10
07      2243    3       CGH     CWB     20:47   21:30
08      2243    4       CWB     POA     21:50   22:50
- AIRCRAFT 19 ─────────────────────────────────
01      2333    1       GIG     CWB     07:00   08:20
02      2333    2       CWB     POA     08:40   09:40
03      2336    1       POA     CWB     10:00   11:00
04      2336    2       CWB     BSB     11:20   13:09
05      9999    1       BSB     BSB     14:00   20:00
06      2216    1       BSB     REC     20:53   23:30
- AIRCRAFT 20 ─────────────────────────────────
01      2100    1       FLN     CGH     07:26   08:27
02      2100    2       CGH     GIG     09:05   10:05
03      2100    3       GIG     SSA     10:30   12:29
04      2285    1       SSA     GIG     16:00   17:59
05      2285    2       GIG     CGH     18:30   19:27
06      2144    1       CGH     SDU     21:14   22:04
- AIRCRAFT 21 ─────────────────────────────────
01      2128    1       CGH     SDU     17:29   18:29
02      2143    1       SDU     CGH     20:00   20:48
```

**AIRCRAFT ROTATION SOLUTION 2**

**Breaking Flight Structure, no ferry flights, no departure time changes     (20 aircraft)**

```
- AIRCRAFT 01 ─────────────────────────────────
01      2201    1       CGR     CGH     05:00   06:13
02      2120    1       CGH     SDU     06:51   07:42
03      2192    1       SDU     PLU     08:30   09:29
04      2198    1       PLU     BSB     09:44   11:08
05      2291    1       BSB     CGH     12:20   14:00
06      2291    2       CGH     CWB     14:30   15:20
07      2291    3       CWB     POA     15:40   16:40
08      2290    1       POA     CWB     17:10   18:10
09      2290    2       CWB     CGH     18:30   19:19
10      2230    1       CGH     PLU     20:00   21:00
11      2230    2       PLU     VIX     21:22   22:10
- AIRCRAFT 02 ─────────────────────────────────
01      2109    1       VIX     PLU     06:25   07:14
02      2109    2       PLU     CGH     07:30   08:25
03      2327    2       CGH     FLN     09:02   09:55
04      2327    3       FLN     POA     10:10   11:00
05      2102    1       POA     FLN     11:30   12:20
06      2102    2       FLN     CGH     12:40   13:32
07      2102    3       CGH     GIG     14:02   15:00
```

```
08    2102    4    GIG    SSA    15:30    17:25
09    2105    1    SSA    GIG    17:50    19:39
10    2105    2    GIG    CGH    20:10    21:15
11    2105    3    CGH    FLN    21:46    22:39
  - AIRCRAFT 03 ──────────────────────────
01    2286    1    CPQ    SDU    06:10    07:10
02    2286    2    SDU    BSB    07:31    08:56
03    2261    1    BSB    SDU    09:40    11:10
04    2261    2    SDU    CGH    11:30    12:29
05    2261    3    CGH    CWB    12:59    13:40
06    2261    4    CWB    MGF    14:00    14:50
07    2262    1    MGF    CWB    15:10    16:00
08    2262    2    CWB    CGH    16:20    17:11
09    2142    1    CGH    SDU    18:43    19:42
10    2232    1    SDU    PLU    20:45    21:40
  - AIRCRAFT 04 ──────────────────────────
01    2224    1    MGF    CWB    06:30    07:20
02    2220    2    CWB    CGH    07:40    08:40
03    2100    2    CGH    GIG    09:05    10:05
04    2334    3    GIG    BSB    10:30    12:00
05    2334    4    BSB    FOR    12:30    15:00
06    2335    1    FOR    BSB    15:30    18:10
07    2335    2    BSB    GIG    18:40    20:10
08    2335    3    GIG    CWB    20:40    22:00
09    2335    4    CWB    POA    22:20    23:20
  - AIRCRAFT 05 ──────────────────────────
01    2220    1    POA    CWB    06:20    07:20
02    2224    2    CWB    CPQ    07:40    08:25
03    2224    3    CPQ    SDU    08:40    09:40
04    2123    1    SDU    CGH    10:28    11:28
05    2124    1    CGH    SDU    12:01    13:01
06    2190    1    SDU    VIX    15:00    15:50
07    2119    1    VIX    PLU    16:10    17:00
08    2119    2    PLU    CGH    17:15    18:15
09    2314    1    CGH    BSB    18:49    20:19
10    2314    2    BSB    FOR    20:49    23:21
  - AIRCRAFT 06 ──────────────────────────
01    2217    1    REC    BSB    06:40    09:13
02    2189    1    BSB    PLU    10:57    12:08
03    2189    2    PLU    VIX    12:28    13:18
04    2191    1    VIX    SDU    13:40    14:40
05    2127    1    SDU    CGH    15:55    16:45
06    2103    1    CGH    FLN    17:10    18:05
07    2103    2    FLN    POA    18:20    19:10
08    2332    1    POA    CWB    19:30    20:30
09    2332    2    CWB    GIG    20:50    22:10
  - AIRCRAFT 07 ──────────────────────────
01    2327    1    BSB    CGH    06:56    08:30
02    2112    2    CGH    BSB    09:07    10:30
03    2242    3    BSB    SSA    13:50    15:50
04    2243    1    SSA    BSB    16:20    18:08
05    2243    2    BSB    CGH    18:38    20:10
06    2243    3    CGH    CWB    20:47    21:30
07    2235    4    CWB    MGF    21:50    22:40
  - AIRCRAFT 08 ──────────────────────────
01    2100    1    FLN    CGH    07:26    08:27
02    2206    1    CGH    PLU    09:09    10:20
03    2207    1    PLU    CGH    10:35    11:46
04    2126    1    CGH    SDU    14:50    15:40
05    2193    2    SDU    VIX    16:40    17:40
06    2235    1    VIX    SDU    18:00    19:00
07    2235    2    SDU    CPQ    19:20    20:20
08    2235    3    CPQ    CWB    20:40    21:25
```

```
09      2243    4       CWB     POA     21:50   22:50
- AIRCRAFT 09 ─────────────────────────────────────────
01      2202    1       CGH     PLU     06:58   08:20
02      2202    2       PLU     SSA     08:35   10:05
03      2202    3       SSA     REC     10:30   11:40
04      2202    4       REC     FOR     12:00   13:10
05      2211    1       FOR     REC     15:50   17:00
06      2211    2       REC     SSA     17:30   18:40
07      2211    3       SSA     PLU     19:00   20:31
08      2211    4       PLU     CGH     20:46   22:02
- AIRCRAFT 10 ─────────────────────────────────────────
01      2315    1       FOR     BSB     06:40   08:56
02      2315    2       BSB     CGH     09:42   11:09
03      2236    1       CGH     CGR     11:45   13:14
04      2237    1       CGR     CGH     16:30   18:03
05      2326    1       CGH     BSB     20:06   21:41
- AIRCRAFT 11 ─────────────────────────────────────────
01      2333    1       GIG     CWB     07:00   08:20
02      2333    2       CWB     POA     08:40   09:40
03      2336    1       POA     CWB     10:00   11:00
04      2336    2       CWB     BSB     11:20   13:09
05      2337    1       BSB     CWB     15:54   17:40
06      2337    2       CWB     POA     18:00   19:00
08      2200    1       CGH     CGR     22:27   23:55
- AIRCRAFT 12 ─────────────────────────────────────────
01      2203    1       PLU     SDU     07:00   08:00
02      2135    1       SDU     CGH     09:00   10:07
03      2242    2       CGH     BSB     11:50   13:20
04      9999    1       BSB     BSB     14:00   20:00
05      2216    1       BSB     REC     20:53   23:30
- AIRCRAFT 13 ─────────────────────────────────────────
01      2112    1       NVT     CGH     07:40   08:37
02      2101    1       CGH     CWB     09:12   10:00
03      2242    1       CWB     CGH     10:30   11:18
04      2208    1       CGH     PLU     12:05   13:09
05      2223    1       PLU     CGH     13:26   14:31
06      2140    1       CGH     SDU     15:52   16:59
07      2260    2       SDU     BSB     17:41   19:08
08      2287    1       BSB     SDU     19:41   21:10
09      2287    2       SDU     CPQ     21:32   22:32
- AIRCRAFT 14 ─────────────────────────────────────────
01      2133    1       SDU     CGH     06:20   07:20
02      2134    1       CGH     SDU     07:46   08:47
03      2224    4       SDU     VIX     10:00   11:00
04      2194    1       VIX     SDU     11:20   12:20
05      2194    2       SDU     BSB     12:40   14:10
06      2193    1       BSB     SDU     14:50   16:20
07      2141    1       SDU     CGH     17:19   18:09
08      2252    1       CGH     GYN     18:47   20:20
09      2252    2       GYN     BSB     20:40   21:10
- AIRCRAFT 15 ─────────────────────────────────────────
01      2197    1       FOR     REC     06:00   07:10
02      2197    2       REC     SSA     07:30   08:40
03      2197    3       SSA     GIG     09:00   11:00
04      2197    4       GIG     CGH     11:30   12:26
05      2180    1       CGH     POA     12:51   14:20
06      2104    1       POA     FLN     19:20   20:10
07      2104    2       FLN     CGH     20:30   21:29
- AIRCRAFT 16 ─────────────────────────────────────────
01      2251    1       BSB     GYN     07:40   08:10
02      2251    2       GYN     CGH     08:30   09:57
03      2256    1       CGH     NVT     10:24   11:20
04      2257    1       NVT     CGH     15:05   16:06
```

```
05     2330   1     CGH   GIG   16:32  17:35
06     2330   2     GIG   SSA   18:00  19:50
07     2330   3     SSA   REC   20:10  21:25
08     2330   4     REC   FOR   21:45  23:00
- AIRCRAFT 17 ─────────────────────────────────
01     2334   1     POA   CWB   07:20  08:20
02     2334   2     CWB   GIG   08:40  10:00
03     2100   3     GIG   SSA   10:30  12:29
04     2285   1     SSA   GIG   16:00  17:59
05     2285   2     GIG   CGH   18:30  19:27
06     2130   1     CGH   SDU   20:13  20:52
07     2131   1     SDU   CGH   21:16  22:09
- AIRCRAFT 18 ─────────────────────────────────
01     2121   1     SDU   CGH   08:00  08:51
02     2122   1     CGH   SDU   09:21  10:11
03     2125   1     SDU   CGH   13:26  14:23
04     2210   1     CGH   PLU   14:52  15:57
05     2302   1     PLU   BSB   16:12  17:25
06     2303   1     BSB   PLU   18:10  19:19
07     2233   1     PLU   SDU   19:36  20:29
- AIRCRAFT 19 ─────────────────────────────────
01     2136   1     CGH   SDU   10:29  11:29
02     2139   1     SDU   CGH   14:26  15:20
03     2260   1     CGH   SDU   16:31  17:21
04     2129   1     SDU   CGH   18:45  19:44
05     2144   1     CGH   SDU   21:14  22:04
- AIRCRAFT 20 ─────────────────────────────────
01     2128   1     CGH   SDU   17:29  18:29
02     2143   1     SDU   CGH   20:00  20:48
```

**AIRCRAFT ROTATION SOLUTION 3**

**Breaking Flight Structure, Ferry flights accepted, no departure time changes (19 aircraft)**

```
- AIRCRAFT 01 ─────────────────────────────────
01     2201   1     CGR   CGH   05:00  06:13
02     2120   1     CGH   SDU   06:51  07:42
03     2192   1     SDU   PLU   08:30  09:29
04     2198   1     PLU   BSB   09:44  11:08
05     2291   1     BSB   CGH   12:20  14:00
06     2291   2     CGH   CWB   14:30  15:20
07     2291   3     CWB   POA   15:40  16:40
08     2290   1     POA   CWB   17:10  18:10
09     2290   2     CWB   CGH   18:30  19:19
10     2230   1     CGH   PLU   20:00  21:00
11     2230   2     PLU   VIX   21:22  22:10
- AIRCRAFT 02 ─────────────────────────────────
01     2109   1     VIX   PLU   06:25  07:14
02     2109   2     PLU   CGH   07:30  08:25
03     2327   2     CGH   FLN   09:02  09:55
04     2327   3     FLN   POA   10:10  11:00
05     2102   1     POA   FLN   11:30  12:20
06     2102   2     FLN   CGH   12:40  13:32
07     2102   3     CGH   GIG   14:02  15:00
08     2102   4     GIG   SSA   15:30  17:25
09     2105   1     SSA   GIG   17:50  19:39
10     2105   2     GIG   CGH   20:10  21:15
11     2105   3     CGH   FLN   21:46  22:39
- AIRCRAFT 03 ─────────────────────────────────
01     2220   1     POA   CWB   06:20  07:20
02     2224   2     CWB   CPQ   07:40  08:25
```

```
03    2224   3    CPQ   SDU   08:40   09:40
04    2123   1    SDU   CGH   10:28   11:28
05    2124   1    CGH   SDU   12:01   13:01
06    2190   1    SDU   VIX   15:00   15:50
07    2119   1    VIX   PLU   16:10   17:00
08    2119   2    PLU   CGH   17:15   18:15
09    2252   1    CGH   GYN   18:47   20:20
10    2252   2    GYN   BSB   20:40   21:10
- AIRCRAFT 04 ───────────────────────────────
01    2100   1    FLN   CGH   07:26   08:27
02    2206   1    CGH   PLU   09:09   10:20
03    2207   1    PLU   CGH   10:35   11:46
04    2261   3    CGH   CWB   12:59   13:40
05    2261   4    CWB   MGF   14:00   14:50
06    2262   1    MGF   CWB   15:10   16:00
07    2262   2    CWB   CGH   16:20   17:11
08    2130   1    CGH   SDU   20:13   20:52
09    2131   1    SDU   CGH   21:16   22:09
10    2251   1    BSB   GYN   07:40   08:10
- AIRCRAFT 05 ───────────────────────────────
01    2197   1    FOR   REC   06:00   07:10
02    2197   2    REC   SSA   07:30   08:40
03    2197   3    SSA   GIG   09:00   11:00
04    2197   4    GIG   CGH   11:30   12:26
05    2180   1    CGH   POA   12:51   14:20
06    9999   1    POA   CGH   14:50   16:19   Ferry Flight
07    2128   1    CGH   SDU   17:29   18:29
08    2235   2    SDU   CPQ   19:20   20:20
09    2235   3    CPQ   CWB   20:40   21:25
10    2235   4    CWB   MGF   21:50   22:40
- AIRCRAFT 06 ───────────────────────────────
01    2286   1    CPQ   SDU   06:10   07:10
02    2286   2    SDU   BSB   07:31   08:56
03    2261   1    BSB   SDU   09:40   11:10
04    2125   1    SDU   CGH   13:26   14:23
05    2126   1    CGH   SDU   14:50   15:40
06    2193   2    SDU   VIX   16:40   17:40
07    2235   1    VIX   SDU   18:00   19:00
08    2143   1    SDU   CGH   20:00   20:48
09    2144   1    CGH   SDU   21:14   22:04
- AIRCRAFT 07 ───────────────────────────────
01    2133   1    SDU   CGH   06:20   07:20
02    2134   1    CGH   SDU   07:46   08:47
03    2224   4    SDU   VIX   10:00   11:00
04    2194   1    VIX   SDU   11:20   12:20
05    2139   1    SDU   CGH   14:26   15:20
06    2140   1    CGH   SDU   15:52   16:59
07    2141   1    SDU   CGH   17:19   18:09
08    2142   1    CGH   SDU   18:43   19:42
09    2232   1    SDU   PLU   20:45   21:40
- AIRCRAFT 08 ───────────────────────────────
01    2224   1    MGF   CWB   06:30   07:20
02    2220   2    CWB   CGH   07:40   08:40
03    2100   2    CGH   GIG   09:05   10:05
04    2334   3    GIG   BSB   10:30   12:00
05    2334   4    BSB   FOR   12:30   15:00
06    2335   1    FOR   BSB   15:30   18:10
06    2335   2    BSB   GIG   18:40   20:10
07    2335   3    GIG   CWB   20:40   22:00
08    2335   4    CWB   POA   22:20   23:20
- AIRCRAFT 09 ───────────────────────────────
01    2217   1    REC   BSB   06:40   09:13
02    2189   1    BSB   PLU   10:57   12:08
```

```
03      2189    2       PLU     VIX     12:28   13:18
04      2191    1       VIX     SDU     13:40   14:40
05      2127    1       SDU     CGH     15:55   16:45
06      2103    1       CGH     FLN     17:10   18:05
07      2103    2       FLN     POA     18:20   19:10
08      2332    1       POA     CWB     19:30   20:30
09      2332    2       CWB     GIG     20:50   22:10
─ AIRCRAFT 10 ─────────────────────────────────
01      2202    1       CGH     PLU     06:58   08:20
02      2202    2       PLU     SSA     08:35   10:05
03      2202    3       SSA     REC     10:30   11:40
04      2202    4       REC     FOR     12:00   13:10
05      2211    1       FOR     REC     15:50   17:00
06      2211    2       REC     SSA     17:30   18:40
07      2211    3       SSA     PLU     19:00   20:31
08      2211    4       PLU     CGH     20:46   22:02
09      2200    1       CGH     CGR     22:27   23:55
─ AIRCRAFT 11 ─────────────────────────────────
01      2112    1       NVT     CGH     07:40   08:37
02      2101    1       CGH     CWB     09:12   10:00
03      2242    1       CWB     CGH     10:30   11:18
04      2208    1       CGH     PLU     12:05   13:09
05      2223    1       PLU     CGH     13:26   14:31
06      2330    1       CGH     GIG     16:32   17:35
07      2330    2       GIG     SSA     18:00   19:50
08      2330    3       SSA     REC     20:10   21:25
09      2330    4       REC     FOR     21:45   23:00
─ AIRCRAFT 12 ─────────────────────────────────
01      2333    1       GIG     CWB     07:00   08:20
02      2333    2       CWB     POA     08:40   09:40
03      2336    1       POA     CWB     10:00   11:00
04      2336    2       CWB     BSB     11:20   13:09
05      2193    1       BSB     SDU     14:50   16:20
06      2260    2       SDU     BSB     17:41   19:08
07      2287    1       BSB     SDU     19:41   21:10
08      2287    2       SDU     CPQ     21:32   22:32
─ AIRCRAFT 13 ─────────────────────────────────
01      2327    1       BSB     CGH     06:56   08:30
02      2112    2       CGH     BSB     09:07   10:30
03      2242    3       BSB     SSA     13:50   15:50
04      2243    1       SSA     BSB     16:20   18:08
05      2243    2       BSB     CGH     18:38   20:10
06      2243    3       CGH     CWB     20:47   21:30
07      2243    4       CWB     POA     21:50   22:50
─ AIRCRAFT 14 ─────────────────────────────────
01      2121    1       SDU     CGH     08:00   08:51
02      2122    1       CGH     SDU     09:21   10:11
03      2261    2       SDU     CGH     11:30   12:29
04      2210    1       CGH     PLU     14:52   15:57
05      2302    1       PLU     BSB     16:12   17:25
06      2303    1       BSB     PLU     18:10   19:19
07      2233    1       PLU     SDU     19:36   20:29
─ AIRCRAFT 15 ─────────────────────────────────
01      2315    1       FOR     BSB     06:40   08:56
02      2315    2       BSB     CGH     09:42   11:09
03      2236    1       CGH     CGR     11:45   13:14
04      2237    1       CGR     CGH     16:30   18:03
05      2314    1       CGH     BSB     18:49   20:19
06      2314    2       BSB     FOR     20:49   23:21
─ AIRCRAFT 16 ─────────────────────────────────
01      2334    1       POA     CWB     07:20   08:20
02      2334    2       CWB     GIG     08:40   10:00
03      2100    3       GIG     SSA     10:30   12:29
```

```
04   2285  1    SSA   GIG   16:00  17:59
05   2285  2    GIG   CGH   18:30  19:27
06   2326  1    CGH   BSB   20:06  21:41
- AIRCRAFT 17 ───────────────────────────────
01   2136  1    CGH   SDU   10:29  11:29
02   2194  2    SDU   BSB   12:40  14:10
03   2337  1    BSB   CWB   15:54  17:40
04   2337  2    CWB   POA   18:00  19:00
05   2104  1    POA   FLN   19:20  20:10
06   2104  2    FLN   CGH   20:30  21:29
- AIRCRAFT 18 ───────────────────────────────
01   2203  1    PLU   SDU   07:00  08:00
02   2135  1    SDU   CGH   09:00  10:07
03   2242  2    CGH   BSB   11:50  13:20
04   9999  1    BSB   BSB   14:00  20:00
05   2216  1    BSB   REC   20:53  23:30
- AIRCRAFT 19 ───────────────────────────────
01   2251  2    GYN   CGH   08:30  09:57
02   2256  1    CGH   NVT   10:24  11:20
03   2257  1    NVT   CGH   15:05  16:06
04   2260  1    CGH   SDU   16:31  17:21
05   2129  1    SDU   CGH   18:45  19:44
```

**AIRCRAFT ROTATION SOLUTION 4**

**Breaking flight structure accepted, Ferry flights accepted, +- 5 minutes in departure time accepted. Aircraft Number Fixed in 18. Cancelations Accepted.**

```
- AIRCRAFT 01 ───────────────────────────────
01   2201  1    CGR   CGH   05:00  06:13
02   2120  1    CGH   SDU   06:51  07:42
03   2192  1    SDU   PLU   08:30  09:29
04   2198  1    PLU   BSB   09:44  11:08
05   2291  1    BSB   CGH   12:20  14:00
06   2291  2    CGH   CWB   14:30  15:20
07   2291  3    CWB   POA   15:40  16:40
08   2290  1    POA   CWB   17:10  18:10
09   2290  2    CWB   CGH   18:30  19:19
10   2230  1    CGH   PLU   20:00  21:00
11   2230  2    PLU   VIX   21:22  22:10
- AIRCRAFT 02 ───────────────────────────────
01   2109  1    VIX   PLU   06:25  07:14
02   2109  2    PLU   CGH   07:30  08:25
03   2327  2    CGH   FLN   09:02  09:55
04   2327  3    FLN   POA   10:10  11:00
05   2102  1    POA   FLN   11:30  12:20
06   2102  2    FLN   CGH   12:40  13:32
07   2102  3    CGH   GIG   14:02  15:00
08   2102  4    GIG   SSA   15:30  17:25
09   2105  1    SSA   GIG   17:50  19:39
10   2105  2    GIG   CGH   20:10  21:15
11   2105  3    CGH   FLN   21:46  22:39
- AIRCRAFT 03 ───────────────────────────────
01   2197  1    FOR   REC   06:00  07:10
02   2197  2    REC   SSA   07:30  08:40
03   2197  3    SSA   GIG   09:00  11:00
04   2197  4    GIG   CGH   11:30  12:26
05   2180  1    CGH   POA   12:51  14:20
06   9999  1    POA   CGH   14:50  16:20   Ferry Flight
07   2128  1    CGH   SDU   17:29  18:29
08   2235  2    SDU   CPQ   19:20  20:20
09   2235  3    CPQ   CWB   20:40  21:25
```

```
10     2235   4     CWB   MGF   21:50  22:40
- AIRCRAFT 04 ──────────────────────────────
01     2286   1     CPQ   SDU   06:10  07:10
02     2286   2     SDU   BSB   07:31  08:56
03     2261   1     BSB   SDU   09:40  11:10
04     2261   2     SDU   CGH   11:30  12:29
05     2261   3     CGH   CWB   12:59  13:40
06     2261   4     CWB   MGF   14:00  14:50
07     2262   1     MGF   CWB   15:10  16:00
08     2262   2     CWB   CGH   16:20  17:11
09     2142   1     CGH   SDU   18:43  19:42
10     2232   1     SDU   PLU   20:45  21:40
- AIRCRAFT 05 ──────────────────────────────
01     2133   1     SDU   CGH   06:20  07:20
02     2134   1     CGH   SDU   07:46  08:47
03     2224   4     SDU   VIX   10:00  11:00
04     2194   1     VIX   SDU   11:20  12:20
05     2194   2     SDU   BSB   12:40  14:10
06     2193   1     BSB   SDU   14:50  16:20
07     2193   2     SDU   VIX   16:40  17:40
08     2235   1     VIX   SDU   18:00  19:00
09     2143   1     SDU   CGH   20:00  20:48
10     2144   1     CGH   SDU   21:14  22:04
- AIRCRAFT 06 ──────────────────────────────
01     2220   1     POA   CWB   06:20  07:20
02     2224   2     CWB   CPQ   07:40  08:25
03     2224   3     CPQ   SDU   08:40  09:40
04     2123   1     SDU   CGH   10:28  11:28
05     2124   1     CGH   SDU   12:01  13:01
06     2125   1     SDU   CGH   13:26  14:23
07     2126   1     CGH   SDU   14:50  15:40
08     2141   1     SDU   CGH   17:19  18:09
09     2252   1     CGH   GYN   18:47  20:20
10     2252   2     GYN   BSB   20:40  21:10
- AIRCRAFT 07 ──────────────────────────────
01     2121   1     SDU   CGH   08:00  08:51
02     2122   1     CGH   SDU   09:21  10:11
03     9999   1     SDU   CGH   10:31  11:10  Ferry Flight
04     2208   1     CGH   PLU   12:05  13:09
05     2223   1     PLU   CGH   13:26  14:31
06     2210   1     CGH   PLU   14:52  15:57  + 4 min
07     2302   1     PLU   BSB   16:12  17:25  + 4 min
08     2303   1     BSB   PLU   18:10  19:19
09     2233   1     PLU   SDU   19:36  20:29
- AIRCRAFT 08 ──────────────────────────────
01     2224   1     MGF   CWB   06:30  07:20
02     2220   2     CWB   CGH   07:40  08:40
03     2100   2     CGH   GIG   09:05  10:05
04     2334   3     GIG   BSB   10:30  12:00
05     2334   4     BSB   FOR   12:30  15:00
06     2335   1     FOR   BSB   15:30  18:10
07     2243   2     BSB   CGH   18:38  20:10
08     2243   3     CGH   CWB   20:47  21:30
09     2243   4     CWB   POA   21:50  22:50
- AIRCRAFT 09 ──────────────────────────────
01     2100   1     FLN   CGH   07:26  08:27
02     2206   1     CGH   PLU   09:09  10:20
03     2207   1     PLU   CGH   10:35  11:46
04     9999   1     CGH   SDU   12:16  12:55  Ferry Flight
05     2139   1     SDU   CGH   14:26  15:20
06     2260   1     CGH   SDU   16:31  17:21
07     2129   1     SDU   CGH   18:45  19:44
08     2130   1     CGH   SDU   20:13  20:52
```

```
09      2131   1     SDU    CGH    21:16  22:09
- AIRCRAFT 10 ────────────────────────────────────
01      2217   1     REC    BSB    06:40  09:13
02      2189   1     BSB    PLU    10:57  12:08
03      2189   2     PLU    VIX    12:28  13:18
04      9999   1     VIX    SDU    13:48  14:38   Ferry Flight
05      2127   1     SDU    CGH    15:55  16:45
06      2103   1     CGH    FLN    17:10  18:05
07      2103   2     FLN    POA    18:20  19:10
08      2332   1     POA    CWB    19:30  20:30
09      2332   2     CWB    GIG    20:50  22:10
- AIRCRAFT 11 ────────────────────────────────────
01      2333   1     GIG    CWB    07:00  08:20
02      2333   2     CWB    POA    08:40  09:40
03      2336   1     POA    CWB    10:00  11:00
04      2336   2     CWB    BSB    11:20  13:09
05      2242   3     BSB    SSA    13:50  15:50
06      2243   1     SSA    BSB    16:20  18:08
07      2335   2     BSB    GIG    18:40  20:10
08      2335   3     GIG    CWB    20:40  22:00
09      2335   4     CWB    POA    22:20  23:20
- AIRCRAFT 12 ────────────────────────────────────
01      2327   1     BSB    CGH    06:56  08:30
02      2112   2     CGH    BSB    09:07  10:30
03      9999   1     BSB    VIX    11:00  13:00   Ferry Flight
04      2191   1     VIX    SDU    13:40  14:40
05      2190   1     SDU    VIX    15:00  15:50
06      2119   1     VIX    PLU    16:10  17:00
07      2119   2     PLU    CGH    17:15  18:15
08      2314   1     CGH    BSB    18:49  20:19
09      2314   2     BSB    FOR    20:49  23:21
- AIRCRAFT 13 ────────────────────────────────────
01      2202   1     CGH    PLU    06:58  08:20
02      2202   2     PLU    SSA    08:35  10:05
03      2202   3     SSA    REC    10:30  11:40
04      2202   4     REC    FOR    12:00  13:10
05      2211   1     FOR    REC    15:50  17:00
06      2211   2     REC    SSA    17:30  18:40
07      2211   3     SSA    PLU    19:00  20:31
08      2211   4     PLU    CGH    20:46  22:02
09      2200   1     CGH    CGR    22:27  23:55
- AIRCRAFT 14 ────────────────────────────────────
01      2315   1     FOR    BSB    06:40  08:56
02      2315   2     BSB    CGH    09:42  11:09
03      2236   1     CGH    CGR    11:45  13:14
04      9999   1     CGR    CGH    13:44  14:57   Ferry Flight
05      2140   1     CGH    SDU    15:52  16:59
06      2260   2     SDU    BSB    17:41  19:08
07      2287   1     BSB    SDU    19:41  21:10
08      2287   2     SDU    CPQ    21:32  22:32
- AIRCRAFT 15 ────────────────────────────────────
01      2251   1     BSB    GYN    07:40  08:10
02      2251   2     GYN    CGH    08:30  09:57
03      2256   1     CGH    NVT    10:24  11:20
04      2257   1     NVT    CGH    15:05  16:06
05      2330   1     CGH    GIG    16:32  17:35
06      2330   2     GIG    SSA    18:00  19:50
07      2330   3     SSA    REC    20:10  21:25
08      2330   4     REC    FOR    21:45  23:00
- AIRCRAFT 16 ────────────────────────────────────
01      2112   1     NVT    CGH    07:40  08:37
02      2101   1     CGH    CWB    09:12  10:00
03      2242   1     CWB    CGH    10:30  11:18
```

```
04      2242   2      CGH   BSB    11:50  13:20
05      2337   1      BSB   CWB    15:54  17:40
06      2337   2      CWB   POA    18:00  19:00
07      2104   1      POA   FLN    19:20  20:10
08      2104   2      FLN   CGH    20:30  21:29
- AIRCRAFT 17 ───────────────────────────────────────────
01      2203   1      PLU   SDU    07:00  08:00
02      2135   1      SDU   CGH    09:00  10:07
03      2136   1      CGH   SDU    10:29  11:29    + 3 min
04      9999   1      SDU   BSB    12:02  13:27    Ferry Flight
05      9999   1      BSB   BSB    14:00  20:00
06      2216   1      BSB   REC    20:53  23:30
- AIRCRAFT 18 ───────────────────────────────────────────
01      2334   1      POA   CWB    07:20  08:20
02      2334   2      CWB   GIG    08:40  10:00
03      2100   3      GIG   SSA    10:30  12:29
04      2285   1      SSA   GIG    16:00  17:59
05      2285   2      GIG   CGH    18:30  19:27
06      2326   1      CGH   BSB    20:06  21:41

- CANCELED  ───────────────────────────────────────────
2237   1      CGR   CGH    16:30  18:03
```