

# The Airline Game (8 Years) - lud.io

## The Tutorial

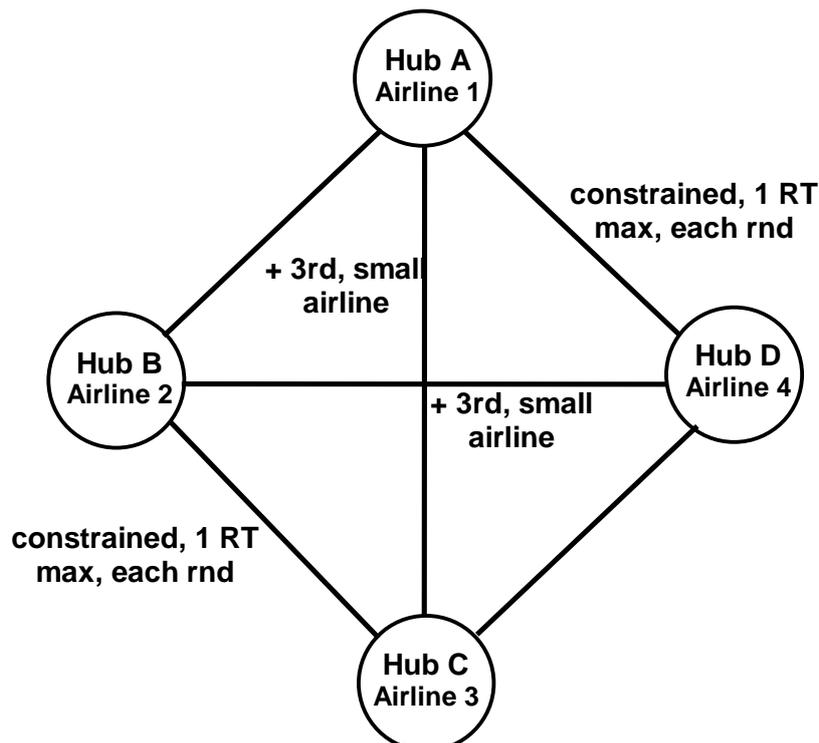
First, start by playing the tutorial for about 45 minutes (click on « the tutorial » on this page: <https://lud.io/transport> . You will also find the companion document of the tutorial here: <https://lud.io/resources/site/manual/aireconsim-tutorial.pdf> . Be careful, there are other tutorials on other pages). It is only intended to introduce you to the structure and interface of the game, you do not need to spend much time thinking about your best strategies (and anyway the robots of the tutorial are not particularly smart competitors).

After playing the tutorial, you can start the main game, vs robots. The robots will probably be difficult to beat. They do not “cheat”, but they follow a rather elaborate (though not optimal) strategy. So, do not worry if you do not manage to beat them.

## Game Start

You are competing with 3 major (robot) airlines of your region (Air Betland, Charly Sky and Delines Corp).

Each airline is based on a hub and can only operate flights between its hub and the 3 other hubs. For example, airline 3 - Charly Sky - and airline 4 - Delines Corp - can both operate flights between airports C and D. Consequently there are only two airlines operating on each route. Except on two routes, A/C and B/D, on which a third robot-airline, "Air Small 1" or "Air Small 2", is also present (but the total number of potential travelers is the same on these routes as on the other routes).



Moreover, routes between B/C and A/D are congested at the start of the game and traffic is regulated: you can only operate one roundtrip per round on these routes (airport landing/takeoff rights are called airport slots : By extension, we will also talk about slots here, and consider that you have only one slot on these routes).

For now, costs are the same as in the tutorial (note that you will have to pay about 8000€ of fixed cost per route and **per round**. You can avoid these costs only if you decide to leave the route (i.e. if you select 0 round trip in off-peak **AND** in peak period). Demand on each route is also the same as in the tutorial.

# Aircraft Characteristics

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Aircraft	RoundTrip Capacity	Annual Cost (ie for 2 Rnd)	Roundtrip Cost	Passenger Cost	CO2 per RoundTrip (tons)	CO2 per seat	Average cost per seat (full use)	Average cost per seat (partial use)
✂ Br837	300	€6,150	€8,100	€4	48	0.16	37.2	47.5
✂ Al420	400	€7,560	€9,680	€4	60	0.15	33.6	43.1
✂ Br857	500	€8,750	€10,850	€4	71	0.142	30.4	39.2
✂ Al440	600	€9,720	€11,800	€4	83	0.138	27.8	35.9
✂ Br837LessSeats	240	€6,150	€8,100	€4	48	0.2	46.6	59.4
✂ Al420LessSeats	320	€7,560	€9,680	€4	60	0.188	42.1	53.9
✂ Br857LessSeats	400	€8,750	€10,850	€4	71	0.178	38.1	49
✂ Al440LessSeats	480	€9,720	€11,800	€4	83	0.173	34.7	44.8
✂ Br837MoreSeats	360	€6,150	€8,100	€4	48	0.133	31	39.6
✂ Al420MoreSeats	480	€7,560	€9,680	€4	60	0.125	28	35.9
✂ Br857MoreSeats	600	€8,750	€10,850	€4	71	0.118	25.4	32.7
✂ Al440MoreSeats	720	€9,720	€11,800	€4	83	0.115	23.1	29.9
✂ CleanBr837	300	€7,995	€7,472	€4	41	0.137	38.2	51.6
✂ CleanAl420	400	€9,828	€8,896	€4	51	0.128	34.5	46.8
✂ CleanBr857	500	€11,375	€9,922	€4	60	0.12	31.2	42.6
✂ CleanAl440	600	€12,636	€10,715	€4	71	0.118	28.4	38.9
✂ CleanBr837LessSeats	240	€7,995	€7,472	€4	41	0.171	47.8	64.4
✂ CleanAl420LessSeats	320	€9,828	€8,896	€4	51	0.159	43.2	58.5
✂ CleanBr857LessSeats	400	€11,375	€9,922	€4	60	0.15	39	53.2
✂ CleanAl440LessSeats	480	€12,636	€10,715	€4	71	0.148	35.5	48.6
✂ CleanBr837MoreSeats	360	€7,995	€7,472	€4	41	0.114	31.9	43
✂ CleanAl420MoreSeats	480	€9,828	€8,896	€4	51	0.106	28.8	39
✂ CleanBr857MoreSeats	600	€11,375	€9,922	€4	60	0.1	26	35.5
✂ CleanAl440MoreSeats	720	€12,636	€10,715	€4	71	0.099	23.7	32.4

**Note** Average costs given in this table are only based on annual and roundtrip costs and not on passenger cost or any other cost.

**Note** Additional Fixed cost for each Route: €8,000

**Note** One Aircraft can make one roundtrip every round. If you choose 5 roundtrips in peak periods and 2 roundtrips in off-peak periods using Br837, you will need to lease 5 aircrafts during the whole year.

In the example above, your costs over the year will equal  $5 * €6,150$  for the annual costs +  $7 * €8,100$  for the costs related to the  $(1 * 5 + 1 * 2)$  roundtrips, + the costs related to the passengers (€4 for each passenger).

In this game, you do not have access to the "cleaner" planes

## SCENARIO

Here is what will happen during the game (more details will be given inside the game).

### YEAR 2

- From now on, airlines have the ability to choose to put more or less seats (+/- 20%) in your planes (aircraft called "MoreSeats" or "LessSeats").
  - o The Roundtrip and Plane leasing costs remain the same as with standard aircraft.
  - o The more seats in a plane, the less comfortable the flight is. Of course, this will have an impact on demand. Business travelers will put more value on comfort than leisure travelers.

### YEAR 3

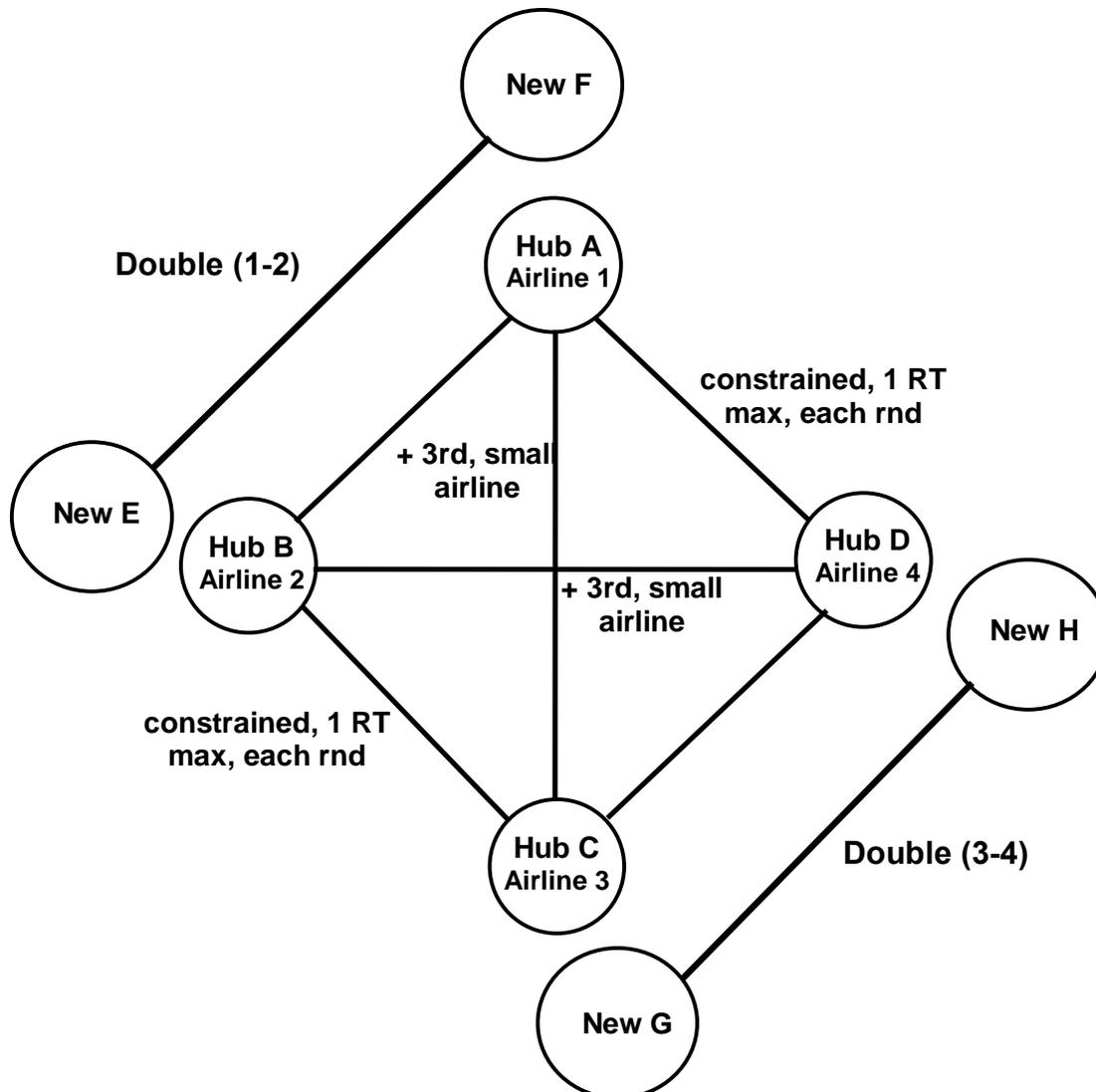
- A "fixed" tax is introduced, €12000 per year for each route over which an airline operates.

### YEAR 4

- The tax introduced in year 3 is removed
- The congested and regulated route is not congested and regulated anymore.
- A new law forbids price discrimination on the market that used to be congested:
  - o On this market, airlines will have to keep the same price in phases 2 and 3 as in the first phase of a round. On other markets, they will still be able to change their price.

## YEAR 5

- The law forbidding price discrimination is revoked.
- In each universe, 2 new routes - with double demand- appear. This year, only 2 airlines can operate on these routes. The 2 other airlines will be able to enter only in year 7 or after, if they accept to pay a small entry cost, and unless incumbents saturate the airports' capacity with many flights (cf "New Markets and Airport Slots" below).



## YEAR 6

- Reallocation of the slots on the double markets through the grandfather rule. No entry this year.

## YEAR 7

- 2 new entrants can operate on the new routes that appeared in year 5, unless the incumbents have fully used their slots in year 6. The grandfather rule for slot allocation on these markets will also remain valid in year 8.

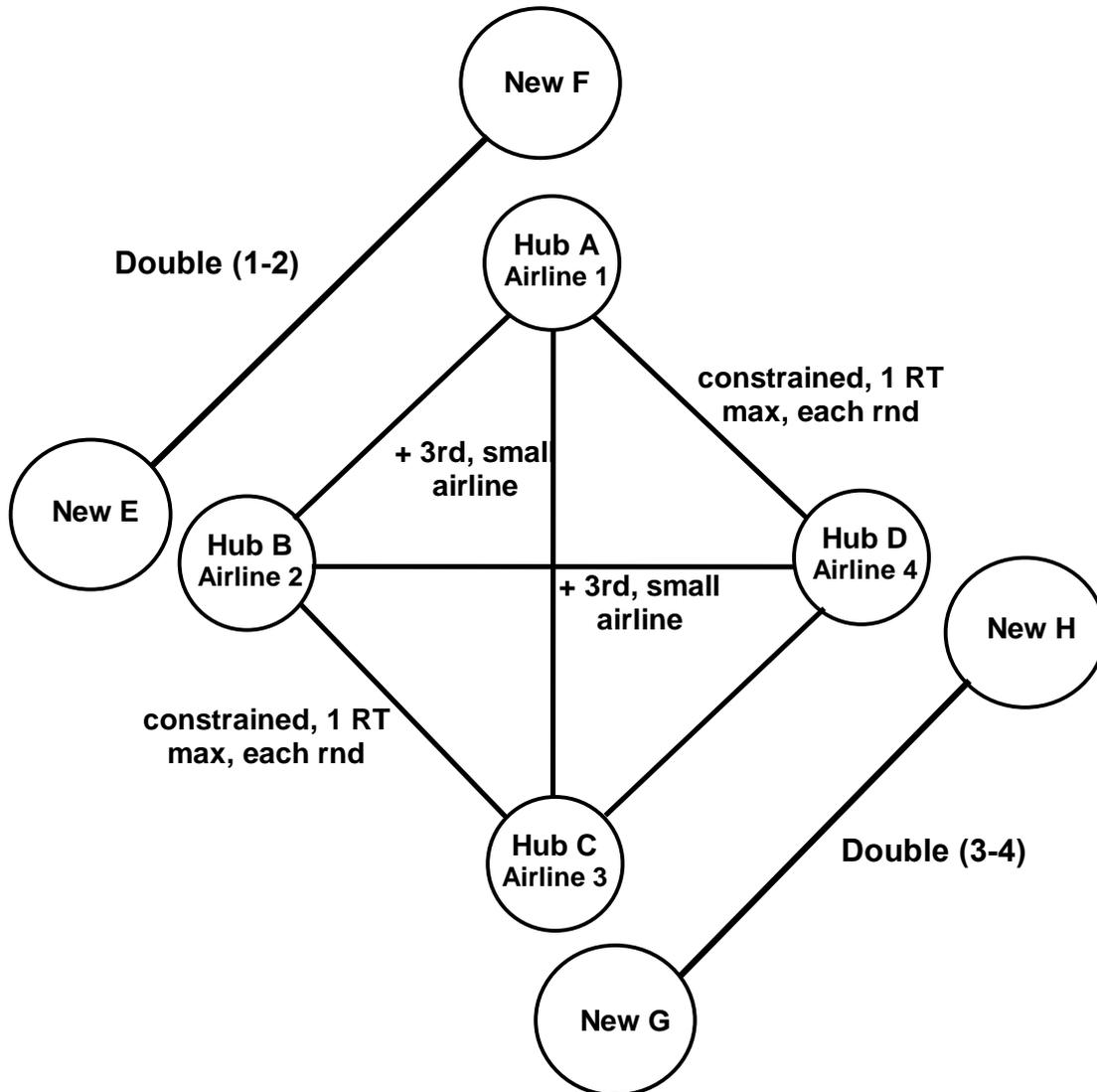
## YEAR 8

- Reallocation of the slots on the double markets through the grandfather rule.

## New Markets and Airport Slots (read in year 5)

### Airport Slot Allocation

In year 5, you will have access to new routes, on which there are twice as many potential travelers as on “standard” routes (each potential traveler having the same behavior as on standard routes).



You and Airline 2 will have access to new market **Double (1-2)**, and Airlines 3 and 4 to new market **Double (3-4)**...

Two years later, in year 7, market **Double (1-2)** will also be open for Airlines 3 and 4 and market **Double (3-4)** will be open for you and Airline 2 (if an airline enters in year 7 or 8, it will have to incur a one-shot entry cost of 20000€).

One of the airports on each of these new routes is congested: To plan one Roundtrip on this route, an airline first needs to own one **landing/take-off slot** on the congested airport (one slot gives the right to operate one roundtrip in peak-period plus one roundtrip in off-peak period). For example to be able to select 7 Roundtrips in peak period and 3 Roundtrips in off-peak periods, you first need to have 7 slots over the whole year.

In year 5, both of the airlines which are present on a Double route are granted 6 slots. To determine the next years' slots allocation, the **grand-father rule** will be used. This means that if an Airline fully uses all its slots to plan roundtrips in both rounds, it will keep them the year after. To give an

example, if you have 7 slots, and select 7RT in peak and only 2RT in off-peak, the regulator will consider that you are using  $(7+2)/2=4.5$  slots over the whole year: Next year, you will keep 4 or 5 slots, depending on the result of a random draw, and the remaining 2 or 3 will be put into the **pool** to be reallocated among every active airline.

Allocation of the pool at the start of the year: In year 7 or 8, new entrants (airlines with 0 slots) are the first to be granted their first slot. Then, remaining slots are shared equally between all potentially active airlines. (When several airlines have the same priority over a single slot, the slot is allocated randomly)

### Example

12 slots on an airport

#### *Year n:*

Airline 1 has 7 slots, operates 6 RT in peak period and 3 RT in off-peak period

Airline 2 has 5 slots, operates 5 RT in peak period and 2 RT in off-peak period

The 2 other airlines are not present, they will only be able to enter the route at year  $n+1$

#### *Allocation for Year $n+1$ :*

The regulator computes that airline 1 has used  $(6+3)/2=4.5$  slots and airline 2  $(5+2)/2=3.5$  slots on average. After a random draw, airline 1 is granted 5 slots and airline 2 is granted 3 slots thanks to the grandfather rule. There are a total of 12 slots to allocate, so the remaining 4 slots are put into the pool, to be reallocated to all 4 airlines.

First, the 2 entrants have a priority over their first slots, so airlines 3 and 4 are each granted 1 slot.

There remain 2 slots to be allocated equally between all 4 airlines, with no team having a priority over them. So 2 airlines are randomly drawn and are granted one of the 2 last slots. For example, if airlines 1 and 4 have been drawn, the final allocation is:

Airline 1: 6 slots

Airline 2: 3 slots

Airline 3: 1 slot

Airline 4: 2 slots

On this market, active airlines (called incumbents) can build barriers to entry against new entrants, but for this they need to both operate one flight for each of their slots, in peak period **and** in off-peak period!