```fsharp
 1  // week6
 2  open System
 3  type Lid = string
 4  type Flight = string
 5  type Airport = string
 6  type Route = (Flight * Airport) list
 7  type LuggageCatalogue = (Lid * Route) list
 8  type ArrivalCatalogue = (Airport * Lid list) list
 9  // 1
10  let lc =
11      [ ("DL 016-914",
12          [ ("DL 189", "ATL")
13            ("DL 124", "BRU")
14            ("SN 733", "CPH") ])
15        ("SK 222-142",
16          [ ("SK 208", "ATL")
17            ("DL 125", "BRU")
18            ("SK 122", "JFK") ])
19        ("SK 222-142",
20          [ ("SK 208", "ATL")
21            ("DL 124", "BRU")
22            ("SK 122", "JFK") ]) ]
23
24  let rec findRoute (lid1, lc) =
25      match lc with
26      | (lid, route) :: lt when lid1 = lid -> route
27      | (lid, route) :: lt -> findRoute (lid1, lt)
28      | _ -> failwith ("No such a piece of luggage")
29
30  // findRoute ("SK 222-143", lc)
31
32  // 2
33  let route =
34      [ ("DL 189", "ATL")
35        ("DL 124", "BRU")
36        ("SN 733", "CPH") ]
37
38  let rec inRoute flight1 (route: Route) =
39      match route with
40      | (flight, airport) :: rt when flight1 = flight -> true
41      | (flight, airport) :: rt -> inRoute flight1 rt
42      | [] -> false
43
44  //inRoute "DL 123"  []
45
46  // 3
47  let rec withFlight f lc =
48      match lc with
49      | (lid, route) :: lt when inRoute f route -> lid::(withFlight f lt)
```

```fsharp
50        | (lid, route) :: lt -> (withFlight f lt)
51        | [] -> []
52
53   withFlight "DL 124" lc
54   // withFlight "SK 122" lc
55
56   // 4
57   let rec insert lid airport ac =
58       match ac with
59       | [] -> [(airport,[lid])]
60       // if find the airport, add the lid in the airport done
61       | (ap,lids)::act when ap=airport -> (ap,lid::lids)::act //lids is lid_list
62       // if dom't find the airport, keep head, and then check the tail
63       | (ap,lids)::act -> (ap,lids)::(insert lid airport act)
64
65   let rec extend (lid, r, ac) =
66       match r with
67       | [] -> ac
68       // We need a help function that adding lid into corresponding airport in ac
69       | (flight,airport)::rt -> extend (lid, rt, (insert lid airport ac))
70
71   let ac = [("ATL", ["SK 222-142"]);
72            ("BRU", ["SK 222-142"]);
73            ("JFK", ["SK 222-142"]);]
74
75   extend ("DL 016-914",[("DL 189","ATL"); ("DL 124","BRU"); ("SN 733","CPH")],[])
76
77   // let result1 = extend ("DL 016-914", route, ac)
```