Assignment 1: Relational Database Normalization

작성자 2022-24670 송종현

0. Introduction

As the one who is interested in aerospace engineering and industry, data with regard to the Korean aviation industry were gathered. Downloaded CSV files are as below:

- Airworthiness* Directives (감항성개선지시현황) (Source)
- Korean Registered Aircrafts (항공기 등록현황) (Source)
- Aircraft Model Information (세계항공기 정보) (Source)
- Freight Performance on Incheon Int'l Airport (인천공항 항공사별 노선별 운송실적) (Source)

Airworthiness: the fact that an aircraft is in working condition and safe to fly

1. Preprocessing & DB Normalization

1-1 Airworthiness Directives (감항성개선지시현황) (Source)- 3 tables decomposed

AD ê°œì–‰ë²ˆí˜¸ (Number)	ë°œí–‰ê¸°ê´€ (Issued by)	AD ê°œì–‰ì¼ìž (Issue date)	ì œëª© (Subject)	ìœ ë¹¨ì¼ (Effective date)	ëª¨ë ë (Model)	ì™¸êµAD ê²°ê³¼	ì œìž‘ì‚¬	ì²¨ë¶€íŒŒì¼ (Attachment)
2020-222	US	12/24/2020	Repetitive inspections for cracking of fastener holes at a certain station of the center wing box	1/27/2021	B737-400 B737-400	2020-26-09	BOEING COMPANY	2020-26-09.pdf AD ë¬¸ì„œ
2020-174R1	EU	12/22/2020	ATA 65 Tail Rotor Drive - Tail Rotor Drive Flange / Shaft Flexible Coupling Inspection / Modification	1/4/2021	AS-365N2 AS-365N2 AS-365N3 EC-155B1	2020-0287	AIRBUS INDUSTRIE	EASA_AD_2020-0287.pdf AD ë¬¸ì„œ
2013-189R1	US	12/22/2020	Repetitive inspections for cracking of certain skin panels of the fuselage	1/25/2021	B737-400 B737-400	2020-26-04	The Boeing Company	2020-26-04.pdf AD ë¬¸ì„œ
2020-140R1	EU	12/21/2020	ATA36 Pneumatic - Pylon / Wing Interface Bleed Duct and Fuel Pipe Inspection	1/1/2021	A380-800	2020-0286	AIRBUS INDUSTRIE	EASA_AD_2020-0286.pdf AD ë¬¸ì„œ
2018-120R1	EU	12/21/2020	ATA 64 Tail Rotor - Blade Re-identification / Life Limit	12/25/2020	EC135P2+	2018-0168R1	AIRBUS HELICOPTERS	EASA_AD_2018-0168R1.pdf AD ë¬¸ì„œ
2012-009R1	EU	12/21/2020	ATA 31 Indicating / Recording Systems - Flight Data Recording System Modification (Software Update)	1/1/2021	A380-800	2020-0285	AIRBUS INDUSTRIE	EASA_AD_2020-0285.pdf AD ë¬¸ì„œ
2020-221	EU	12/18/2020	ATA 64 Tail Rotor - Blades Inspection	12/31/2020	EC135P2+	2020-0282	AIRBUS HELICOPTERS	EASA_AD_2020-0282.pdf AD ë¬¸ì„œ
2019-203R2	EU	12/18/2020	ATA 28 Fuel - Fuel Pump Inspection	12/31/2020	A330-200 A330-300	2020-0283	AIRBUS INDUSTRIE	EASA_AD_2020-0283.pdf AD ë¬¸ì„œ
2020-220	US	12/17/2020	Ultrasonic inspection (USI) of the HPT rotor stage 2 disk	1/21/2021	GENX-2B67B GENX-2B67/P GENX-1B GENX-1B	2020-25-10	GE	2020-25-10.pdf AD ë¬¸ì„œ

There are several problems

1. It DOES NOT satisfy 1NF. The model column has multiple values.
2. The attachment column does not give any necessary information.

By preprocessing (deleting *attachment* column and giving unique value per each row), the given table has satisfied 1NF.

	Number	Issued by	Issue date	subject	Effective date	model	Foreign AD	manufacture
1	2022-045	US	3/20/2022	ATA 34 Navigation - Airplane Flight Manual Revisior	3/16/2022	B747-400	6/16/2022	The Boeing Company
2	2022-045	US	3/20/2022	ATA 34 Navigation - Airplane Flight Manual Revisior	3/16/2022	B747-400(BDSF)	6/16/2022	The Boeing Company
3	2022-045	US	3/20/2022	ATA 34 Navigation - Airplane Flight Manual Revisior	3/16/2022	B747-400F	6/16/2022	The Boeing Company
4	2022-045	US	3/20/2022	ATA 34 Navigation - Airplane Flight Manual Revisior	3/16/2022	B747-400SF	6/16/2022	The Boeing Company
5	2022-045	US	3/20/2022	ATA 34 Navigation - Airplane Flight Manual Revisior	3/16/2022	B747-400	6/16/2022	The Boeing Company
6	2022-045	US	3/20/2022	ATA 34 Navigation - Airplane Flight Manual Revisior	3/16/2022	B747-400(BDSF)	6/16/2022	The Boeing Company
7	2022-045	US	3/20/2022	ATA 34 Navigation - Airplane Flight Manual Revisior	3/16/2022	B747-400F	6/16/2022	The Boeing Company
8	2022-045	US	3/20/2022	ATA 34 Navigation - Airplane Flight Manual Revisior	3/16/2022	B747-400SF	6/16/2022	The Boeing Company
9	2022-044	US	3/14/2022	ATA 54 Nacelles / Pylons - Inlet Cowl Modification	4/15/2022	B777-200	6/11/2022	The Boeing Company
10	2022-044	US	3/14/2022	ATA 54 Nacelles / Pylons - Inlet Cowl Modification	4/15/2022	B777-300	6/11/2022	The Boeing Company
11	2022-044	US	3/14/2022	ATA 54 Nacelles / Pylons - Inlet Cowl Modification	4/15/2022	B777-200	6/11/2022	The Boeing Company
12	2022-044	US	3/14/2022	ATA 54 Nacelles / Pylons - Inlet Cowl Modification	4/15/2022	B777-300	6/11/2022	The Boeing Company

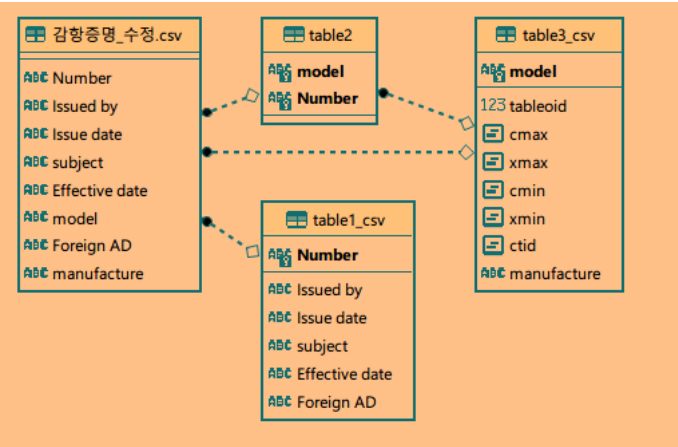
Let us check the relation between columns to normalize the given database to 2NF and 3NF.

Given the database in 1NF, we can figure out a tuple of (model, number) that can uniquely define each row. Thus, to be in 2NF, there should be no non-prime attribute that is functionally dependent on any subset of primary keys.

As seen above, If we know the number, we can know “Issued by”, “Issue date”, “subject”, “Effective date”, “Foreign AD”. All of those are defined iff the number is given. Also, we can know manufacture when the model is given (ex. Boeing 777 is

manufactured by Boeing, literally)

Also, as there are no transitive dependencies between columns, the third normal form is completed as below.



(NOTE: unwanted columns revealed on table 3. the only intended is manufacture)

model and number is a foreign key to table1 and table3, each.

Summary

(Model, Number): Primary Keys and foreign keys to table1 and 3

Model ⇒ manufacture

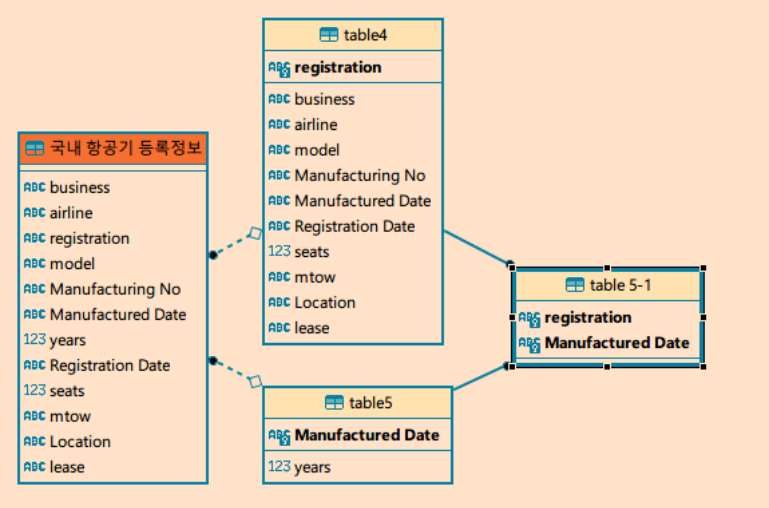
Number ⇒ (Issued by, Issue date, subject, Effective date, Foreign AD)

1-2 Korean Registered Aircrafts (항공기 등록현황)- 3 tables created

국내 항공기 등록정보 | Enter a SQL expression to filter results (use Ctrl+Space)

	business	airline	registration	model	Manufac	Manu	years	Registration Date	seats	mtow	Location	lease
1	항공기사용사업	(재)스타항공우주	HL9471	MI-2	529936096	86.09.30	35	12.04.19	9	3550kg	예천군 감천면	구매
2	항공기사용사업	(주)가디언즈 항공	HL1156	C-172S	172S9537	03.11.09	18	12.01.06	4	2550lbs	김포공항	임차
3	항공기사용사업	(주)가디언즈 항공	HL1163	C-172S	172S8394	00.03.06	22	12.09.24	4	1156.6kg	양양공항	구매
4	항공기사용사업	(주)가디언즈 항공	HL1257	C-172S	172S8939	01.09.10	20	15.12.04	4	2550lbs	양양국제공항	구매
5	항공기사용사업	(주)더스카이	HL9493	MI-2	5210725098	88.09.25	33	10.12.27	9	3550kg	예천군 감천면	구매
6	항공기사용사업	(주)더스카이	HL9494	MI-2	562817043	73.01.01	49	11.01.05	9	3550kg	예천군 감천면	구매
7	소형항공기운송사업	(주)더스카이	HL9301	BELL206B	8550	78.07.19	43	12.10.18	5	1450kg	예천군 감천면	구매
8	소형항공기운송사업	(주)더스카이	HL9303	BELL206L-1	45594	81.01.01	41	14.03.17	7	4150lbs	예천군 감천면	구매
9	항공기사용사업	(주)더스카이	HL9622	MI-2	5410217047	87.04.15	34	16.01.18	9	3550kg	예천군 감천면	구매
10	소형항공기운송사업	(주)더스카이	HL9699	S-76A	760295	90.10.31	31	17.06.07	14	10800lbs	예천군 감천면	구매
11	항공기사용사업	(주)더스카이	HL9664	S-76A	760187	84.03.21	38	20.03.12	14	10.800lbs	예천군 감천면	구매
12	항공기사용사업	(주)더스카이	HL9670	S-76C+	760554	03.12.01	18	20.12.21	14	11700lbs	경북 예천군 감천면 충효로 1078	구매
13	항공기사용사업	(주)더스카이	HL9676	S-76C	760551	03.11.25	18	21.09.27	14	11700lbs	경북 예천군 감천면 충효로 1078	구매
14	항공기사용사업	(주)더스카이	HL9685	S-76C+	760533	03.02.03	19	22.01.28	14	11700lbs	경북 예천군 감천면 충효로 1078	구매
15	항공기사용사업	(주)미도지리정보	HL1139	T-206H	T20608992	10.06.15	11	11.05.25	6	1723kg	김포공항	구매
16	항공기사용사업	(주)새한지앤아이	HL5113	C-208B	20880949	02.04.19	19	07.10.01	11	4111kg	김포공항	구매
17	항공기사용사업	(주)성준항공	HL9186	BELL206L-3	51347	90.03.30	32	07.11.23	7	1932kg	김포공항	구매
18	항공기사용사업	(주)성준항공	HL6145	R-44II	13012	10.11.11	11	10.12.20	4	2500lbs	김포공항	구매
19	항공기사용사업	(주)스팩코어	HL1193	C-172R	17281179	06.09.01	15	14.01.07	4	2450lbs	울산공항	구매
20	항공기사용사업	(주)스팩코어	HL1194	C-172R	17281180	06.08.18	15	14.01.07	4	2450lbs	울산공항	구매
21	항공기사용사업	(주)스팩코어	HL2039	PA-34-220T	3449045	98.02.03	24	14.09.22	5	4750lbs	양양국제공항	구매
22	항공기사용사업	(주)스팩코어	HL1256	C-172R	17280099	97.06.17	24	15.10.05	4	1111kg	양양공항	구매
23	항공기사용사업	(주)신한에어	HL1202	C-172S	172S10864	08.12.12	13	14.05.28	4	1111kg	전남 영암군 미암면	구매
24	항공기사용사업	(주)신한에어	HL1203	C-172S	172S9936	05.09.09	16	14.05.28	4	1111kg	전남 영암	구매
25	소형항공기운송사업	(주)에어필립	HL6143	R-44II	12850	09.06.25	12	09.08.06	4	2500lbs	김포공항	구매
26	항공기사용사업	(주)이엔비에어	HL9290	KA-32A	90-05/008	92.12.31	29	06.09.26	16	12.7ton	경기도 김포시 대곶면 천호로 210	구매
27	항공기사용사업	(주)이엔비에어	HL9295	KA-32A	59-02/009	87.12.20	34	07.01.16	16	12.7ton	경기도 김포시 대곶면 천호로 210	구매

Unlike the first table, the “one value per each row” principle has been observed. the only dependence exists between “Manufactured date” and “years” and other columns functionally depend on registration, a code unique to a single aircraft.



Raw data has been split into two tables, whose primary keys are registration* and manufactured date.

(NOTE: dependencies between model, seats, and mtow-maximum takeoff weight- has been expected. However, depending on various options when purchasing, there were no such relationships between them.)

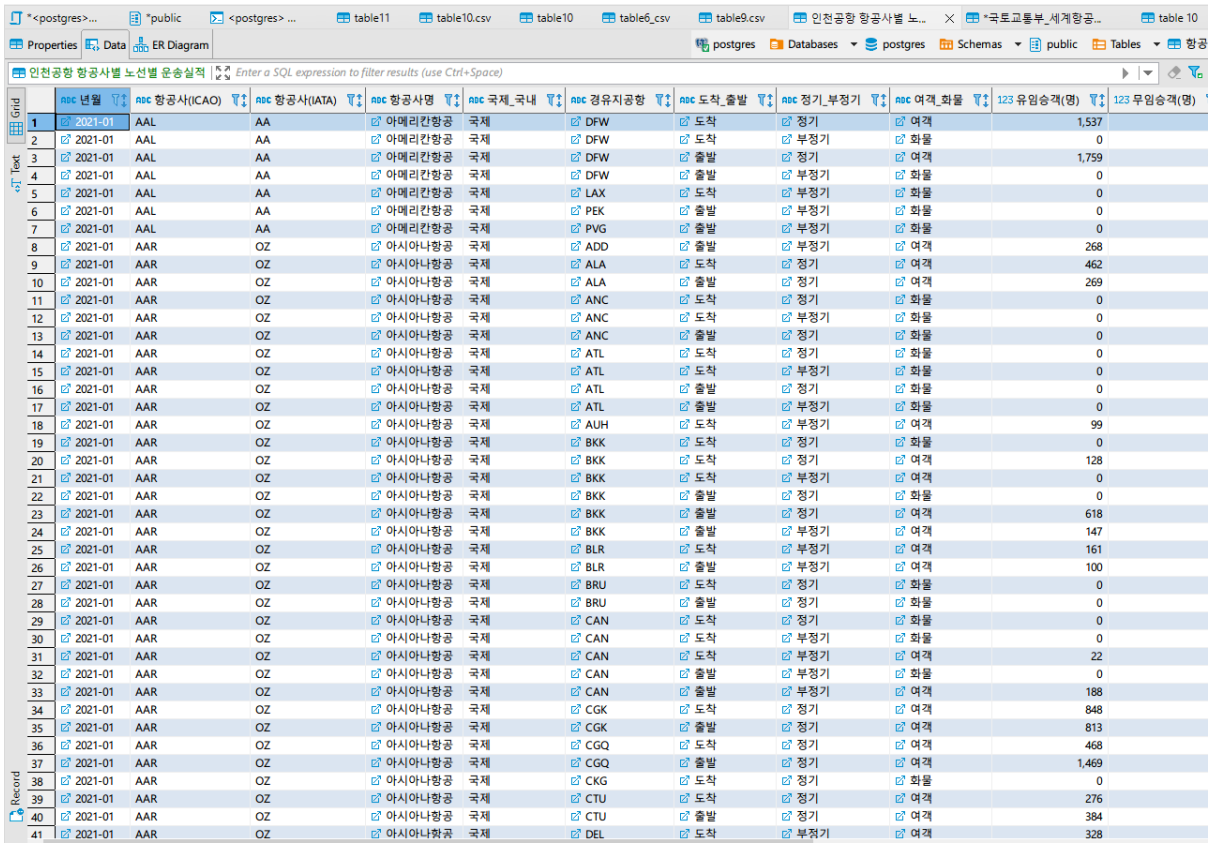
💡 Summary

(Registration, Manufactured Date): Primary Keys and foreign key to table 4 and 5-1

Registration (P key) ⇒ (business, airline, model, Manufacturing No, Manufactured Date, Registration Date, seats, mtow, Location, lease)

Manufactured Date (P key) ⇒ years

1-3 Freight Performance on Incheon Int'l Airport (인천공항 항공사별 노선별 운송실적)- 3 tables decomposed



	년월	항공사(ICAO)	항공사(IATA)	항공사명	국제_국내	경유지공항	도착_출발	정기_부정기	여객_화물	유임승객(명)	무임승객(명)
1	2021-01	AAL	AA	아메리칸항공	국제	DFW	도착	정기	여객	1,537	
2	2021-01	AAL	AA	아메리칸항공	국제	DFW	도착	부정기	화물	0	
3	2021-01	AAL	AA	아메리칸항공	국제	DFW	출발	정기	여객	1,759	
4	2021-01	AAL	AA	아메리칸항공	국제	DFW	출발	부정기	화물	0	
5	2021-01	AAL	AA	아메리칸항공	국제	LAX	도착	부정기	화물	0	
6	2021-01	AAL	AA	아메리칸항공	국제	PEK	출발	부정기	화물	0	
7	2021-01	AAL	AA	아메리칸항공	국제	PVG	출발	부정기	화물	0	
8	2021-01	AAR	OZ	아시아나항공	국제	ADD	출발	부정기	여객	268	
9	2021-01	AAR	OZ	아시아나항공	국제	ALA	도착	정기	여객	462	
10	2021-01	AAR	OZ	아시아나항공	국제	ALA	출발	정기	여객	269	
11	2021-01	AAR	OZ	아시아나항공	국제	ANC	도착	정기	화물	0	
12	2021-01	AAR	OZ	아시아나항공	국제	ANC	도착	부정기	화물	0	
13	2021-01	AAR	OZ	아시아나항공	국제	ANC	출발	정기	화물	0	
14	2021-01	AAR	OZ	아시아나항공	국제	ATL	도착	정기	화물	0	
15	2021-01	AAR	OZ	아시아나항공	국제	ATL	도착	부정기	화물	0	
16	2021-01	AAR	OZ	아시아나항공	국제	ATL	출발	정기	화물	0	
17	2021-01	AAR	OZ	아시아나항공	국제	ATL	출발	부정기	화물	0	
18	2021-01	AAR	OZ	아시아나항공	국제	AUH	도착	부정기	여객	99	
19	2021-01	AAR	OZ	아시아나항공	국제	BKK	도착	정기	화물	0	
20	2021-01	AAR	OZ	아시아나항공	국제	BKK	도착	정기	여객	128	
21	2021-01	AAR	OZ	아시아나항공	국제	BKK	도착	부정기	여객	0	
22	2021-01	AAR	OZ	아시아나항공	국제	BKK	출발	정기	화물	0	
23	2021-01	AAR	OZ	아시아나항공	국제	BKK	출발	정기	여객	618	
24	2021-01	AAR	OZ	아시아나항공	국제	BKK	출발	부정기	여객	147	
25	2021-01	AAR	OZ	아시아나항공	국제	BLR	도착	부정기	여객	161	
26	2021-01	AAR	OZ	아시아나항공	국제	BLR	출발	부정기	여객	100	
27	2021-01	AAR	OZ	아시아나항공	국제	BRU	도착	정기	화물	0	
28	2021-01	AAR	OZ	아시아나항공	국제	BRU	출발	정기	화물	0	
29	2021-01	AAR	OZ	아시아나항공	국제	CAN	도착	정기	화물	0	
30	2021-01	AAR	OZ	아시아나항공	국제	CAN	도착	부정기	화물	0	
31	2021-01	AAR	OZ	아시아나항공	국제	CAN	도착	부정기	여객	22	
32	2021-01	AAR	OZ	아시아나항공	국제	CAN	출발	부정기	화물	0	
33	2021-01	AAR	OZ	아시아나항공	국제	CAN	출발	부정기	여객	188	
34	2021-01	AAR	OZ	아시아나항공	국제	CGK	도착	정기	여객	848	
35	2021-01	AAR	OZ	아시아나항공	국제	CGK	출발	정기	여객	813	
36	2021-01	AAR	OZ	아시아나항공	국제	CGQ	도착	정기	여객	468	
37	2021-01	AAR	OZ	아시아나항공	국제	CGQ	출발	정기	여객	1,469	
38	2021-01	AAR	OZ	아시아나항공	국제	CKG	도착	정기	화물	0	
39	2021-01	AAR	OZ	아시아나항공	국제	CTU	도착	정기	여객	276	
40	2021-01	AAR	OZ	아시아나항공	국제	CTU	출발	정기	여객	384	
41	2021-01	AAR	OZ	아시아나항공	국제	DEL	도착	부정기	여객	328	

The Database above shows overall transportation in Incheon int'l airport in 2021. To uniquely determine transported passengers and freight, 6 primary keys are required-년월, 항공사명, 경유지공항, 도착_출발, 정기_부정기, 여객_화물. Any other information-국제_국내 and ICAO & IATA code- is determined solely by 경유지공항 and 항공사명. To remove partial dependence (That is, to satisfy 2NF), Raw DB has been split into 3 tables whose primary keys are as below

(NOTE: unwanted columns revealed on every table)

Summary

(년월, 항공사명, 경유지공항, 도착_출발, 정기_부정기, 여객_화물): Primary Keys and 경유지공항, 항공사명 are foreign key to table8 and table9

(년월, 항공사명, 경유지공항, 도착_출발, 정기_부정기, 여객_화물) **(P key)** ⇒ (유임승객, 무임승객, 환승객, 항공화물, 환적화물, 우편물, 수하물)

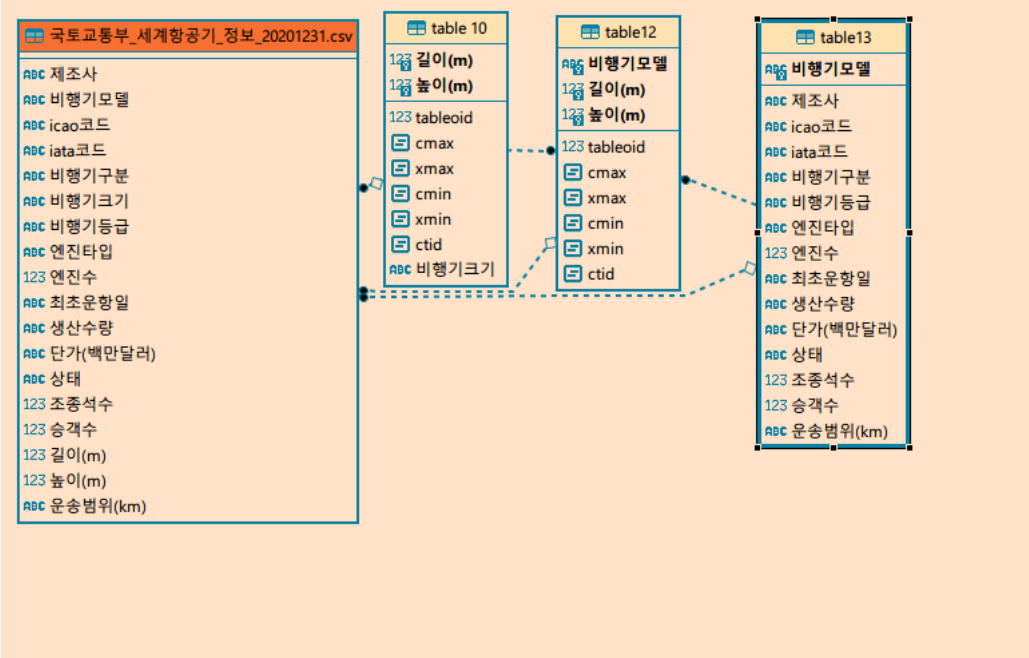
경유지공항 **(P key) ⇒** 국제_국내

항공사명 (**P key**) ⇒ 항공사(ICAO), 항공사(IATA)

1-4 Aircraft Model Information (세계항공기 정보)- 3 Tables Decomposed

	manufacture	model	icao code	iata code	aircraft type	aircraft size	aircraft rank	engine type	# of engines
1	CURTISS	Curtiss C-46 Commando	C46	CWC	LandPlane	MEDIUM	Military transport aircraft	Piston	2
2	CONVAIR	Convair CV-240 / CV-440	CVLP	CV4	LandPlane	MEDIUM	Airliner	Piston	2
3	LOCKHEED	Lockheed L-1049 Super Constellation	CONI	L49	LandPlane	MEDIUM	Airliner	Piston	4
4	DOUGLAS	Douglas DC-6	DC6	D6F	LandPlane	MEDIUM	Airliner/transport aircraft	Piston	4
5	DE HAVILLAND CANADA	DHC-2 Turbo Beaver	DH2T	DHR	LandPlane	LOW	STOLutility transport	Turboprop/Turboshaft	1
6	DE HAVILLAND CANADA	DHC-2 Beaver	DHC2	DHP	LandPlane	LOW	STOLutility transport	Piston	1
7	DE HAVILLAND CANADA	DHC-3 Otter	DHC3	DHL	LandPlane	LOW	STOL utility transport	Piston	1
8	DE HAVILLAND	DH.104 Dove	DOVE	DHD	LandPlane	LOW	short-haul airliner	Piston	2
9	DE HAVILLAND CANADA	DHC-4 Caribou	DHC4	DHC	LandPlane	MEDIUM	STOL Transport	Piston	2
10	GULFSTREAM AEROSPACE	Aerospace G-159 Gulfstream I	G159	GRS	LandPlane	MEDIUM	Business aircraft	Turboprop/Turboshaft	2
11	SIKORSKY	Sikorsky S-58T	S58T	S58	Helicopter	LOW	Helicopter	Turboprop/Turboshaft	1
12	DOUGLAS	Douglas DC-8-50	DC85	D8T	LandPlane	HIGH	Narrow-body airliner	Jet	4
13	DOUGLAS	Douglas DC-8-62	DC86	D8L	LandPlane	HIGH	Narrow-body airliner	Jet	4
14	DOUGLAS	Douglas DC-8-72	DC87	D8Q	LandPlane	HIGH	Narrow-body airliner	Jet	4
15	NAMC	NAMC YS-11	YS11	YS1	LandPlane	MEDIUM	Turbopropairliner	Turboprop/Turboshaft	2
16	AEROSPATIALE	Aerospatiale N 262	N262	ND2	LandPlane	MEDIUM	Turboprop airliner	Turboprop/Turboshaft	2
17	AEROSPATIALE	Aerospatiale SN.601 Corvette	S601	NDC	LandPlane	LOW	Business jet	Jet	2
18	CESSNA	Cessna 310	C310		LandPlane	LOW	Twin-engine cabin monoplane	Piston	2
19	Pilatus Britten-Norman	BN-2A Mk III Trislander	TRIS	BNT	LandPlane	LOW	Airliner	Piston	3
20	DOUGLAS	Douglas DC-9-10	DC91	D91	LandPlane	MEDIUM	Narrow-bodyjet airliner	Jet	2
21	DOUGLAS	Douglas DC-9-20	DC92	D92	LandPlane	MEDIUM	Narrow-bodyjet airliner	Jet	2
22	DOUGLAS	Douglas DC-9-30	DC93	D93	LandPlane	MEDIUM	Narrow-bodyjet airliner	Jet	2
23	DOUGLAS	Douglas DC-9-40	DC94	D94	LandPlane	MEDIUM	Narrow-bodyjet airliner	Jet	2
24	DOUGLAS	Douglas DC-9-50	DC95	D95	LandPlane	MEDIUM	Narrow-bodyjet airliner	Jet	2
25	Piper	Piper PA-31 Navajo	PA31	PA2	LandPlane	LOW	Civil utility aircraft	Piston	2
26	CESSNA	Cessna 152	C152		LandPlane	LOW	Basic trainer	Piston	1
27	CESSNA	Cessna Citation I	C500	CNJ	LandPlane	LOW	Corporate jet	Jet	2
28	ILYUSHIN	Ilyushin IL18	IL18	IL8	LandPlane	MEDIUM	urbopropairlinerandreconnaissance aircraft	Turboprop/Turboshaft	4
29	GAF	GAF Nomad	NOMA	CD2	LandPlane	LOW	lightutility aircraft	Turboprop/Turboshaft	2
30	CESSNA	Cessna 210 Centurion	C210	CN1	LandPlane	LOW	Light aircraft	Piston	1
31	DE HAVILLAND CANADA	DHC-5 Buffalo	DHC5	DHC	LandPlane	MEDIUM	Utility aircraft	Turboprop/Turboshaft	2
32	MITSUBISHI	Mitsubishi Mu-2	MU2	MU2	LandPlane	LOW	Utility transport aircraft	Turboprop/Turboshaft	2
33	SHORT	Short SC.7 Skyvan	SC7	SHS	LandPlane	LOW	Utility aircraft	Turboprop/Turboshaft	2
34	FOKKER	F-27 Firefighter	F27	F27	LandPlane	MEDIUM	Regional airliner	Turboprop/Turboshaft	2
35	TUPOLEV	Tupolev Tu-134	T134	TU3	LandPlane	MEDIUM	Airliner	Jet	2
36	EMBRAER	EMB 110 Bandeirante	E110	EMB	LandPlane	LOW	TurbopropRegional airliner	Turboprop/Turboshaft	2
37	SHORT	Short 330	SH33	SH3	LandPlane	MEDIUM	National origin	Turboprop/Turboshaft	2
38	ILYUSHIN	Ilyushin IL62	IL62	IL6	LandPlane	HIGH	Narrow-bodyjet airliner	Jet	4
39	FOKKER	Fokker 100	F100	100	LandPlane	MEDIUM	Narrow-body Regional jet airliner	Jet	2
40	FOKKER	Fokker 50	F50	F50	LandPlane	MEDIUM	Turbopropregional airliner	Turboprop/Turboshaft	2
41	FOKKER	Fokker 70	F70	F70	LandPlane	MEDIUM	Regional jet	Jet	2

Like 1-2, it satisfies 1NF. Figuring out relations between columns, aircraft size may have an influence on length and height or vice versa. However, there was no explicit relationship. Surprisingly, the model can determine all the properties of an aircraft. (if not, model name lose its meaning) aircraft size(비행기 크기) can be determined by its height and length. Two databases whose primary keys are (길이, 높이) and 비행기모델 are normalized as below.



(NOTE: unwanted columns revealed on table 10 and 12)

> 💡 Summary

(비행기모델, 길이, 높이): Primary Keys and foreign key to table 13 and 10 each.

(길이, 높이) P-keys ⇒ 비행기 크기

비행기모델 P-key ⇒ 제조사,icao코드,iata코드,비행기구분,비행기등급,엔진타입,엔진수,최초운항일,생산수량,"단가(백만달러)",상태,조종석수,승객수,"운송범위(km)"

2. Ten Interesting Questions

To make questions more *interesting,* let us imagine the situation where a public servant in aviation policy makes use of the databases above.

1. Airworthiness Directive 2022-035 “ATA 35 Oxygen - Oxygen Cylinder and Valve Assembly Inspection and Replacement” requires the airlines who own A319-115, A320-200, A321-200, A321-200 NEO. A330-200, A330-300, ATR 72, ATR 72-212A, B747-8, B747-8F to report service bulletin within 15 days. Which companies in Korea are in charge of it?

29	2022-036	EU	3/1	ATA 62 Main Rotor System - Main Rotor Rotating Scissor Assembly Insp	3/2	AW109SP
30	2022-035	US	3/1	ATA 35 Oxygen - Oxygen Cylinder and Valve Assembly Inspection and F	4/4	A319-115
31	2022-035	US	3/1	ATA 35 Oxygen - Oxygen Cylinder and Valve Assembly Inspection and F	4/4	A320-200
32	2022-035	US	3/1	ATA 35 Oxygen - Oxygen Cylinder and Valve Assembly Inspection and F	4/4	A321-200
33	2022-035	US	3/1	ATA 35 Oxygen - Oxygen Cylinder and Valve Assembly Inspection and F	4/4	A321-200 NEO
34	2022-035	US	3/1	ATA 35 Oxygen - Oxygen Cylinder and Valve Assembly Inspection and F	4/4	A330-200
35	2022-035	US	3/1	ATA 35 Oxygen - Oxygen Cylinder and Valve Assembly Inspection and F	4/4	A330-300
36	2022-035	US	3/1	ATA 35 Oxygen - Oxygen Cylinder and Valve Assembly Inspection and F	4/4	ATR 72
37	2022-035	US	3/1	ATA 35 Oxygen - Oxygen Cylinder and Valve Assembly Inspection and F	4/4	ATR 72-212A
38	2022-035	US	3/1	ATA 35 Oxygen - Oxygen Cylinder and Valve Assembly Inspection and F	4/4	B747-8
39	2022-035	US	3/1	ATA 35 Oxygen - Oxygen Cylinder and Valve Assembly Inspection and F	4/4	B747-8F
40	2022-035	US	3/1	ATA 35 Oxygen - Oxygen Cylinder and Valve Assembly Inspection and F	4/4	A321-200 NEO

```
select distinct model, airline from table4 t
where (model like '%A319-115%' or
model like '%A320-200%' or
model like '%A321-200%' or
model like '%A321-200 NEO%' or
model like '%A330-200%' or
model like '%A330-300%' or
model like '%ATR 72%' or
model like '%ATR 72-212A%' or
```

```
model like '%B747-8%' or
model like '%B747-8F%')
```

	model	airline
1	A319-115	SK텔레콤
2	A330-200	대한항공
3	B747-8F	대한항공
4	B747-8	대한항공
5	A330-300	대한항공
6	A321-200	아시아나항공
7	A321-200 NEO	아시아나항공
8	A330-300	아시아나항공
9	A320-200	아시아나항공
10	A320-200	에어로케이항공
11	A320-200	에어부산
12	A321-200 NEO	에어부산
13	A321-200	에어부산
14	A321-200	에어서울
15	A330-300	티웨이항공
16	ATR 72-212A	하이에어
17	ATR 72	하이에어

SK Telecom, Korean Air, Asiana Air, Aero-K Air, Air Busan, Air Seoul, T-way air, hi-air are in charge of it

2. Delegates from the Gambia will visit S.Korea for economic purposes. The Korean government will lease the aircraft from private airlines. Distance between Gambia and S.Korea is 13,287km and 400 people will visit this time. which aircraft from which airline will be appropriate?

```
select 제조사, 비행기모델, "운송범위(km)", 승객수 from table6
where "운송범위(km)">13287 and 승객수>400;
// The first query gave A-330-200, A-330-800neo, A-330-900neo, A-350-900, A-350-1000,
//A-380-800, Boeing 747-400, Boeing 747-8I, Boeing 777-9, Boeing 777-300ER, Boeing 787-9
// as an answer
select distinct model, airline from table4 t
where (model like '%A330-200%' or
model like '%A330-800neo%' or
model like '%A330-900neo%' or
model like '%A350-900%' or
model like '%A350-1000%' or
model like '%A330-300%' or
model like '%A380-800%' or
model like '%B747-400%' or
model like '%B747-8I%' or
model like '%B777-9%' or
model like '%B777-300ER%' or
model like '%B787-9%')
```

Query above gave the answer that

B747-400(BDSF) 아시아나항공
B747-400F 아시아나항공
A330-200 대한항공
A330-300 아시아나항공
A350-900 아시아나항공
A380-800 아시아나항공
A380-800 대한항공
B747-400F 대한항공
A330-300 티웨이항공
B747-400 아시아나항공
B787-9 대한항공
A330-300 대한항공
B777-300ER 대한항공
B747-400SF 아시아나항공
B787-9 에어프레미아 are appropriate.

3. A Big typhoon is forecasted in Jolla Province (전라도) Emergency aid should be carried out to prevent damage to aircraft. which airlines should be in contact in this situation?

```
select distinct "Location", airline from table4 t
  where ("Location" like '전%') or ("Location" like '무안공항') or ("Location" like '광주공항')
```

전라남도, 트랜스헬리, 경운대학교 et cetera should be under appropriate measurement for typhoon

	Location	airline
1	전남 영암군 미암면	(주)신한에어
2	무안공항	써니항공
3	전북임실관촌	트랜스헬리
4	무안공항	숭선학원
5	전남화순	중앙119구조본부
6	전남 영암	경운대학교
7	무안공항	(주)지오스토리
8	무안공항	초당학원
9	무안공항	한국교통대학교
10	전남 영암군 덕진면 소방항공대길 95	산림청
11	전남 영암	(주)신한에어
12	전남 영암군	오**(1221)
13	전남 영암군	경운대학교
14	광주공항	아시아나항공
15	전북 군산시 임피면 영창리 299-35	수에어(남철)
16	전남 영암군	플라잉타이거즈
17	무안공항	중원대학교
18	전남 영암군 덕진면 소방항공대길99	전라남도
19	전북 익산	산림청
20	무안공항	경운대학교
21	전북 남원요천비행장	한양항공
22	무안공항	학교법인 청석학원
23	무안공항	제**(1357)
24	전남 영암	산림청
25	광주공항	광주광역시
26	무안공항	하이에어
27	광주공항	티웨이항공
28	전남 영암	전라남도

4. For aviation safety, the law was enacted that aircraft over 40 years is prohibited to fly over Korean territory. which aircraft will be the target of this law?

```
select table5."Manufactured Date", table4."Manufactured Date", table5.years, table4.registration
from table5, table4
where table5."Manufactured Date"=table4."Manufactured Date" and table5.years>40
```

Overall 50 planes will be prohibited to fly

	Manufactured Date	Manufactured Date	years	registration
35	80.11.14	80.11.14	41	HL1103
36	62.02.01	62.02.01	60	HL9621
37	77.02.01	77.02.01	45	HL9629
38	73.05.15	73.05.15	48	HL9662
39	63.07.01	63.07.01	58	HL9663
40	75.02.17	75.02.17	47	HL9678
41	76.12.15	76.12.15	45	HL9238
42	80.06.10	80.06.10	41	HL1192
43	74.07.30	74.07.30	47	HL1137
44	66.10.06	66.10.06	55	HL0305
45	78.03.24	78.03.24	44	HL8373
46	80.03.20	80.03.20	42	HL9154
47	80.09.20	80.09.20	41	HL9159
48	79.03.12	79.03.12	43	HL9146
49	80.05.20	80.05.20	41	HL9158
50	80.10.12	80.10.12	41	HL9189

5. Korean government bestows *great trade awards* to the city whose freight performance is the best among the destinations of the flight from Incheon international airport. which city will be awarded in 2021?

```
select 경유지공항, SUM("항공화물(kg)")+SUM("환적화물(kg)")+SUM("우편물(kg)")+SUM("수하물(kg)")
from "table7.csv"
group by 경유지공항
order by SUM("항공화물(kg)")+SUM("환적화물(kg)")+SUM("우편물(kg)")+SUM("수하물(kg)") DESC
limit 6
```

Shanghai (PVG), Hong Kong (HKG), Los Angeles (LAX), Tokyo (NRT, HAN), Chicago (ORD) are honored.

	경유지공항	?column?
1	PVG	181,985,025
2	HKG	173,265,837
3	LAX	161,183,572
4	NRT	136,835,449
5	HAN	113,684,879
6	ORD	95,542,593

The last half questions are for the aircraft manager of Korean Air.

6. Korean Air is considering purchasing new aircraft. The first flying date(최초운항일) should not be shall not exceed 10 years. The minimum # of seats should be over 200 for minimum profit. The cost per plane should be less than $500M

   ```
   select 비행기모델, 최초운항일, 승객수, "단가(백만달러)" from table6 t
   where 최초운항일 >'2012-03-28' and 승객수>200 and "단가(백만달러)"<500
   ```

   A-321neo, A-330-800neo, A-330-900neo, A-350-900, A-350-1000, Boeing 777-8 could be possible options

	비행기모델	최초운항일	승객수	단가(백만달러)
1	A-321neo	2014-12-25	206	129
2	A-330-800neo	2017-10-19	406	259
3	A-330-900neo	2017-10-19	440	296
4	A-350-900	2013-06-14	440	334
5	A-350-1000	2013-06-14	480	366
6	Boeing 777-8	2020-01-25	384	410

7. Korean Air wants to cut 5 worst cities depending on freight performance to cut the cost. which are they?

   ```
   select 경유지공항, SUM(case when 항공사명 = '대한항공' then "항공화물(kg)" END)+SUM(case when 항공사명 = '대한항공' then "환적화물(kg)" END)+SUM
   from "table7.csv"
   group by 경유지공항
   order by SUM(case when 항공사명 = '대한항공' then "항공화물(kg)" END)+SUM(case when 항공사명 = '대한항공' then "환적화물(kg)" END)+SUM(case wh
   limit 5
   ```

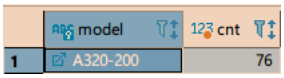
   Contract with Nanjing(NKG), Kagoshima (KOJ), Fukuoka (FUK), Cat Bi (HPH), bandaranaike (CMB) will be ended soon.

	경유지공항	?column?
1	NKG	2,185
2	KOJ	10,209
3	FUK	11,074
4	HPH	13,494
5	CMB	22,689

8. The aircraft model which Airworthiness Directive has required to fix most often will be the main topic for educating engineers. which was it?

   ```
   select model, count(model) cnt
   from table2 t
   group by model
   order by cnt desc
   limit 1
   ```

   A 320-200 will be the main topic



	model	cnt
1	A320-200	76

9. Ms. Cho, the owner of the company, wants to go to Machu Picchu, which is 16,500km distant from Seoul. As she is a very noble person, she wants to depart there at once, without transfer. Is it possible with any aircraft Korean air owns?

```
select table6.비행기모델, table6."운송범위(km)"
from table6
where "운송범위(km)">16500;
// The first query gave "A-340-500" only as an answer
select airline, model
from table4
where (airline like '%대한항공%')
// There is no "A-340-500" on the list
```

   There is no aircraft available to the company.

10. Korean Air will add extra personnel to the cities to which the company actively transports passengers to enhance the passenger experience. The best 5 cities based on data in 2021 will be the ones. which are they?

```
select 경유지공항, SUM(case when 항공사명 = '대한항공' then "유임승객(명)" END)+SUM(case when 항공사명 = '대한항공' then "환승객(명)" END) sum
from "table7.csv"
group by 경유지공항
having SUM(case when 항공사명 = '대한항공' then "유임승객(명)" END)+SUM(case when 항공사명 = '대한항공' then "환승객(명)" END) is not null
order by SUM(case when 항공사명 = '대한항공' then "유임승객(명)" END)+SUM(case when 항공사명 = '대한항공' then "환승객(명)" END) DESC
limit 5
```

   Extra personnel will be sent to Los Angeles, Atlanta, New York, Manila, Tokyo

	경유지공항	sum
1	LAX	38,037
2	ATL	27,253
3	JFK	23,757
4	MNL	22,452
5	NRT	17,075