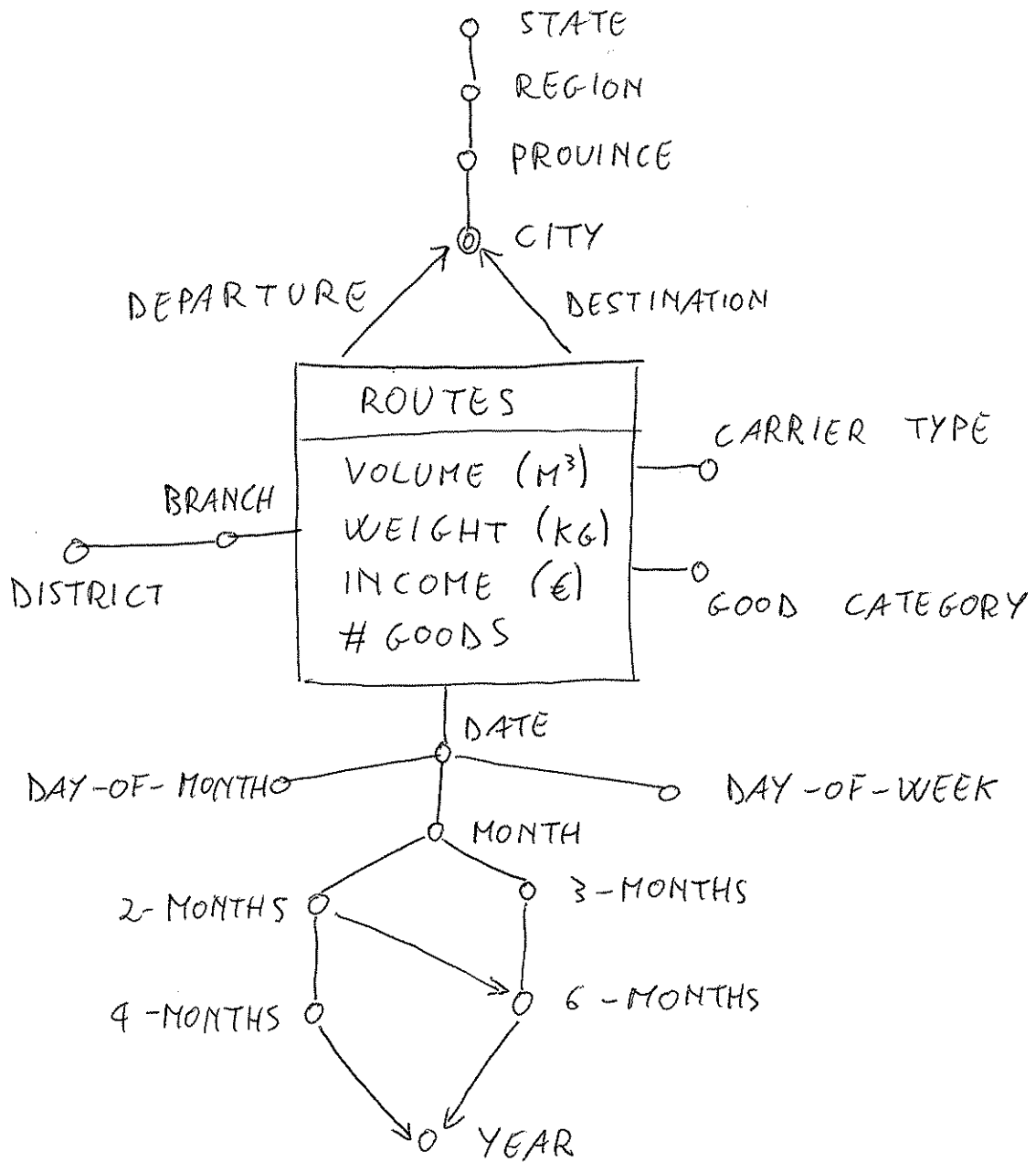


# FACT MODEL



## FACT CARDINALITY

$$\begin{aligned}
 & \# \text{ BRANCH} \times \# \text{ DEPARTURE} \times \# \text{ DESTINATION} \times \# \text{ GOOD CATEGORY} \\
 & \times \# \text{ CARRIER TYPE} \times \# \text{ DATE} \times \# \text{ YEAR} = \\
 & = 200 \cdot 1000 \cdot 1000 \cdot 20 \cdot 5 \cdot 365 \cdot 4 \approx 3 \cdot 10^{13}
 \end{aligned}$$

## LOGIC MODEL

GOOD-CATEGORY (COD-CATEGORY, GOOD-CATEGORY)

CARRIER-TYPE (COD-CARRIER, CARRIER-TYPE)

TIME (COD-TIME, DATE, MONTH, 2-MONTHS, 3-MONTHS,  
4-MONTHS, 6-MONTHS, YEAR, DAY-OF-WEEK,  
DAY-OF-MONTH)

BRANCH (COD-BRANCH, BRANCH, DISTRICT)

PLACE (COD-PLACE, CITY, PROVINCE, REGION, STATE)

ROUTES (COD-CATEGORY, COD-CARRIER, COD-TIME,  
COD-BRANCH, COD-PLACE-DEPARTURE,  
COD-PLACE-DESTINATION, VOLUME, WEIGHT,  
INCOME, #GOODS)

## QUERIES

```
a) SELECT GOOD-CATEGORY, MONTH, YEAR,
      SUM (INCOME) / COUNT (DISTINCT DATE),
      SUM (SUM (INCOME)) OVER (PARTITION
      BY GOOD-CATEGORY, YEAR
      ORDER BY MONTH
      ROWS UNBOUNDED PRECEDING)
FROM PLACE DEP, PLACE DEST, ROUTES R,
GOOD-CATEGORY G, TIME T
WHERE R.COD-PLACE-DEPARTURE = DEP.COD-PLACE AND
R.COD-PLACE-DESTINATION = DEST.COD-PLACE AND
R.COD-CATEGORY = G.COD-CATEGORY AND
R.COD-TIME = T.COD-TIME AND
DEP.STATE = 'ITALY' AND DEST.STATE = 'ITALY'
GROUP BY GOOD-CATEGORY, MONTH, YEAR,
COD-CATEGORY;
```

```

c) SELECT DEP. REGION , DEST. REGION , MONTH
      SUM (SUM (INCOME)) / SUM (SUM (WEIGHT))
      OVER (PARTITION BY DEP. REGION ,
            DEST. REGION , MONTH ) ,
      AVG (SUM (INCOME)) OVER (PARTITION
      BY DEP. REGION , DEST. REGION , MONTH )
FROM   ROUTES R, PLACE DEP , PLACE DEST ,
      TIME T
WHERE  R. COD_PLACE_DEPARTURE = DEP. COD_PLACE AND
      R. COD_PLACE_DESTINATION = DEST. COD_PLACE AND
      R. COD_TIME = T. COD_TIME AND
      YEAR = '2006'
GROUP BY DEP. REGION , DEST. REGION , MONTH , DATE

```

-- ALTERNATIVE SOLUTION

```

SELECT DEP. REGION , DEST. REGION , MONTH
      SUM (INCOME) / SUM (WEIGHT) ,
      SUM (INCOME) / COUNT (DISTINCT DATE)
FROM   ROUTES R, PLACE DEP , PLACE DEST ,
      TIME T
WHERE  R. COD_PLACE_DEPARTURE = DEP. COD_PLACE AND
      R. COD_PLACE_DESTINATION = DEST. COD_PLACE AND
      R. COD_TIME = T. COD_TIME AND
      YEAR = '2006'
GROUP BY DEP. REGION , DEST. REGION , MONTH

```

d) SELECT DISTRICT, CARRIER\_TYPE, MONTH,  
 SUM (INCOME), SUM (VOLUME), YEAR  
 RANK OVER (ORDER BY SUM (VOLUME) DESC)  
 FROM ROUTES R, CARRIER\_TYPE C, BRANCH B,  
 TIME T  
 WHERE R.COD\_CARRIER = C.COD\_CARRIER AND  
 R.COD\_BRANCH = B.COD\_BRANCH AND  
 R.COD\_TIME = T.COD\_TIME  
 GROUP BY DISTRICT, CARRIER\_TYPE, MONTH, YEAR;

	SELECT	FROM	WHERE	GROUP BY
a)	GOOD_CATEGORY MONTH YEAR AGG. INCOME	PLACE DEP PLACE DEST ROUTES GOOD_CATEGORY TIME	DEP.STATE='ITALY' DEST.STATE='ITALY'	GOOD_CATEGORY MONTH YEAR COD_CATEGORY
b)	DEST.PROVINCE YEAR AGG. - INCOME - VOLUME	PLACE DEP PLACE DEST ROUTES CARRIER_TYPE TIME	CARRIER_TYPE='AIR'	DEST.PROVINCE YEAR DEST.STATE
c)	DEP.REGION DEST.REGION MONTH AGG. - WEIGHT - INCOME	PLACE DEP PLACE DEST ROUTES TIME	YEAR='2006'	DEP.REGION DEST.REGION MONTH
d)	DISTRICT CARRIER_TYPE MONTH YEAR AGG. - INCOME - VOLUME	CARRIER_TYPE BRANCH TIME ROUTES		DISTRICT CARRIER_TYPE MONTH YEAR

	SELECT	FROM	WHERE	GROUP BY
e)	DEP. CITY DEST. CITY AGG. - INCOME - WEIGHT	PLACE DEP PLACE DEST ROUTES R TIME T	YEAR = '2005'	DEP. CITY DEST. CITY
f)	BRANCH DEP. REGION 6-MONTHS YEAR AGG. - INCOME - VOLUME - WEIGHT	PLACE DEP ROUTES CARRIER_TYPE TIME BRANCH	YEAR = '2005' YEAR = '2006' CARRIER_TYPE = 'SEA'	BRANCH DEP. REGION 6-MONTHS YEAR
g)	DEP. CITY DISTRICT 9-MONTHS YEAR AGG. - VOLUME - INCOME	PLACE DEP BRANCH TIME ROUTES		DEP. CITY DISTRICT 9-MONTHS YEAR

QUERY	MAXIMUM CARDINALITY
a	$20 \times 12 \times 4 = 960$
b	$300 \times 4 = 1200$
c	$100 \times 100 \times 12 = 1,2 \cdot 10^5$
d	$10 \times 5 \times 12 \times 4 = 2400$
e	$1000 \times 1000 = 10^6$
f	$200 \times 100 \times 2 \times 2 = 8 \cdot 10^4$
g	$1000 \times 10 \times 3 \times 4 = 1,2 \cdot 10^5$