A. OLAP and Data Warehouse

Consider the following query

```
SELECT Item, Brand, MonthSold, Color, SUM(Quantity) AS Sold
FROM Sales
WHERE Price <= 100
AND Color IN {'red', 'pink', 'blue'}
AND Year >= 2010
GROUP BY Item, Brand, MonthSold, Color
```

and the corresponding result shown below as a table:

Item	Brand	MonthSold	Color	Sold
Socks	K7	Oct 2010	red	10
Jeans	Denis	Nov 2011	pink	15
Shoes	K7	Mar 2012	red	5
Sunglasses	Raysun	Oct 2010	blue	20
Shoes	Denis	Nov 2011	blue	25

1) Suppose the query is extended with the WITH CUBE clause.
   a. How many different kinds of aggregation (with the **all** polymorphic value) will be applied by the execution engine?

Indicate your answer here: ___16_____

Explain:
We have 4 dimensions, for each of which we may or may not use the **all** polymorphic value. This gives us $2^4 = 16$ different kinds of aggregation

   b. Is the result of the query necessarily a superset of the table shown above?
   - **X** YES, STRICTLY
   - □ NO
   - □ YES, BUT NOT STRICTLY (IT MAY ALSO BE THE SAME AS THE TABLE ABOVE)

2) Suppose now the query is extended with the WITH ROLLUP clause.
   a. How many different kinds of aggregation (with the **all** polymorphic value) will be applied by the execution engine?

Indicate your answer here: __5_____

   b. Show the result by filling in the table below (the cells below are drawn for your convenience, but you do not necessarily have to fill all the rows)

Item	Brand	MonthSold	Color	Sold
Socks	K7	Oct 2010	red	10
Jeans	Denis	Nov 2011	pink	15
Shoes	K7	Mar 2012	red	5
Sunglasses	Raysun	Oct 2010	blue	20
Shoes	Denis	Nov 2011	blue	25
Socks	K7	Oct 2010	**all**	10
Jeans	Denis	Nov 2011	**all**	15
Shoes	K7	Mar 2012	**all**	5
Sunglasses	Raysun	Oct 2010	**all**	20
Shoes	Denis	Nov 2011	**all**	25
Socks	K7	**all**	**all**	10

Jeans	Denis	**all**	**all**	15
Shoes	K7	**all**	**all**	5
Sunglasses	Raysun	**all**	**all**	20
Shoes	Denis	**all**	**all**	25
Socks	**all**	**all**	**all**	10
Jeans	**all**	**all**	**all**	15
Shoes	**all**	**all**	**all**	30
Sunglasses	**all**	**all**	**all**	20
all	**all**	**all**	**all**	75