Relational Model

Considers these four relations:

CUSTOMER (CUST_ID, CUST_NAME, CUST_ADDRESS)
PRODUCT (PROD_NO, PROD_DESC, PROD_UNITPRICE, PROD_STOCK)
STAFF(STAFF_NAME, STAFF_POSITION)
SALE (CUST_ID, SALE_DATE, PROD_NO, SALE_QTY, SOLD_BY)

*Note that sold_by value is the staff who made the sale also refer to the following tables as seen in an RDBMS

CUSTOMER

CUST_ID	CUST_NAME	CUST_ADDRESS
111	Clive	India Rd
112	Clark	Kent St
113	Charles	Windsor Av
114	Cilla	Black St

PRODUCT

PROD_NO	PROD_DESC	PROD_UNITPRICE	PROD_STOCK
K3	Knife Set	$17.95	105
K5	Ladle	$6.95	0
K11	Scraper	$0.95	66
L12	Rack	$22.95	0
L3	Table	$399.50	4
L6	Stool	$17.95	13

STAFF

STAFF_NAME	STAFF_POSITION
Sandra	Manager
Simon	Clerk
Steve	Packer
Sean	Clerk
Sorcha	Director
Sian	Clerk

SALE

CUST_ID	SALE_DATE	PROD_NO	SALE_QTY	SOLD_BY
112	20170311	K3	6	Simon
114	20170121	K11	1	Simon
114	20170123	K11	1	Simon
113	20161130	L12	5	Sorcha
114	20170228	L12	1	Sean
113	20161129	K3	2	Sean

Using Relational Algebra answer the following queries. You must represent your answer in symbolic notation and where a query has several solutions, your answer must represent the most efficient solution.

1. List names of products that haven't been sold
2. List names of clerks who don't have any sales yet
3. List categories (positions) of staff who have made sales

1. List names of products that haven't been sold.

$$\prod_{\text{prod\_desc}} ((\sigma_{\text{prod\_no}}\text{PRODUCT} - \sigma_{\text{prod\_no}}\text{SALE}) \bowtie \text{PRODUCT})$$

2. List names of clerks who don't have any sales yet.

$$\prod_{\text{staff\_name}} (\sigma_{\text{staff\_position="Clerk"}} ((\sigma_{\text{staff\_name}} \text{STAFF} - \sigma_{\text{sold\_by}}\text{SALE}) \bowtie \text{STAFF}))$$

3. List categories (positions) of staff who have made sales.

$$\text{A} = \rho \text{ staff\_name} \leftarrow \text{sold\_by} (\sigma_{\text{sold\_by}}(\text{SALE}))$$

$$\prod_{\text{staff\_position}} ((\sigma_{\text{staff-name}, \text{ staff-position}} (\text{A})) \bowtie (\text{STAFF}))$$