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
4. **List names of products that haven’t been sold.**

1. **List names of clerks who don’t have any sales yet.**

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