Algorithm 1 Daily Sales Data Processing

1: **procedure** PROCESS-SALES($\mathcal{D}, S, \mathcal{P}, \mathcal{R}, \mathcal{T}$)
2:     Initialize empty dictionary $\mathcal{X}$
3:     **for** $d \in \mathcal{D}$ **do**
4:         Load transaction headers $T_H(d)$
5:         Load transaction line items $T_L(d)$
6:         **if** files are missing or empty **then**
7:             **continue** to next date
8:         **end if**
9:         Merge $T_H(d)$ and $T_L(d)$ on transaction_uid
10:        Filter transactions by sampled sites S
11:        Merge with product data $\mathcal{P}$ and promotions $\mathcal{R}$
12:        Compute unit price:

$$\text{price} = \frac{\text{sales amount}}{\text{quantity sold}}$$

13:        Remove invalid transactions (i.e., negative quantities, non-food)
14:        Group by transaction_uid:
15:        $I(t) \leftarrow$ List of items
16:        $Q(t) \leftarrow$ List of quantities
17:        $P(t) \leftarrow$ List of prices
18:        $D(t) \leftarrow$ List of department categories
19:        $R(t) \leftarrow$ List of promotions
20:        Compute total sales volume:

$$\text{sales\_vol}(t) = \sum_{i=1}^{k} \text{quantity\_sold}(i)$$

21:        Expand transactions into (item, quantity) tuples
22:        Convert transactions into sales records
23:        Store results in $\mathcal{X}[d]$
24:    **end for**
25:    Save $\mathcal{X}$ as 'sales_record_dict.pkl'
26: **end procedure**

Algorithm 2 Sparse Matrix Construction

1: **procedure** Build-Sparse-Matrix($\mathcal{X}$)
2:     Initialize empty sets $\mathcal{I}, \mathcal{T}$
3:     **for** $d \in \mathcal{D}$ **do**
4:         Extract unique items from $\mathcal{X}[d]$
5:         Extract unique transactions from $\mathcal{X}[d]$
6:     **end for**
7:     Assign unique indices to items and transactions
8:     Initialize sparse matrix $M \in \mathbb{R}^{|\mathcal{T}| \times |\mathcal{I}|}$
9:     **for** $d \in \mathcal{D}$ **do**
10:         **for** each transaction t in $\mathcal{X}[d]$ **do**
11:             **for** each item i in $I(t)$ **do**
12:                 $M[\text{index}(t), \text{index}(i)] \leftarrow \text{quantity\_sold}(i)$
13:             **end for**
14:         **end for**
15:     **end for**
16:     Save M as a '.npz' file
17:     Save item and transaction mappings as '.csv' files
18: **end procedure**