Using the my\_guitar\_shop database, write the relational algebra statement(s) necessary to solve the below questions.

1. List the first and last name of any customer that has ordered a Hofner Icon bass guitar.

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| PRODUCTS(\*) | HOFNER⟵ σ(product\_name = ‘Hofner Icon’)(PRODUCTS) |
| PRODUCTS(\*)  ORDER\_LINES(\*) | PRO\_OL⟵HOFNER⨝product\_id=product\_idORDER\_LINES |
| PRODUCTS(\*)  ORDER\_LINES(\*)  ORDERS(\*) | OL\_O⟵PRO\_OL⨝order\_id=order\_idORDERS |
| PRODUCTS(\*)  ORDER\_LINES(\*)  ORDERS(\*)  CUSTOMERS(\*) | O\_C⟵OL\_O⨝customer\_id=customer\_idCUSTOMERS |
| CUSTOMERS(first\_name, last\_name) | RESULT⟵ π(first\_name, last\_name)(O\_C) |

1. Wrong

List the customer’s first and last name, the order id, the order date, and the number of products ordered on their most recent order. Hint: You need to use order\_lines(quantity) in your calculations.

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| ~~ORDERS (~~~~\*~~~~)~~  ~~CUSTOMERS(\*)~~ | ~~C\_O⟵ ORDERS~~~~⨝customer\_id= customer\_id~~ ~~CUSTOMERS~~ |
| ORDERS (order\_id, new\_date)  CUSTOMER(\*) | DATE ⟵ ρ(order\_id, new\_date)( customer\_idℑMAX(order\_date)( C\_O)) |
|  |  |
| ORDERS(order\_id, new\_date)  ORDER\_LINES(\*) | O­\_QUAN⟵ ORDS⨝order\_id= order\_id ORDER\_LINES |
| ORDERS(first\_name, last\_name)  ORDER\_LINES(order\_id, order\_date)  CUSTOMERS(quamtity) | RESULT⟵ π(first\_name, last\_name, order\_id, order\_date, quamtity)(RESULT1) |

1. List the product name, the name(s) of the warehouses the product is in inventory, and the list price for any product whose list price is greater than $1,000.

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| PRODUCTS(\*) | PROS⟵ σ(list\_price>1000)(PRODUCTS) |
| PRODUCT\_LOCATION(\*) | QUAN⟵ σ(qty\_on\_hand > 0)(PRODUCT\_LOCATION) |
| PRODUCTS(\*)  PRODUCTS\_LOCATIONS(\*) | PROS\_LOC⟵ PROS⨝product\_id = prod\_id QUAN |
| PRODUCTS(\*)  PRODUCTS\_LOCATIONS(\*)  WAREHOUSES(\*) | PRO\_WAR⟵ PROS\_LOC⨝wh\_id = warehouse\_idWAREHOUSES |
| PRODUCTS(product\_name, list\_price)  WAREHOUSES(wh\_name) | RESULT⟵ π(product\_name, wh\_name, list\_price)PRO\_WAR |

1. Write the Plain English for the following relational algebra statements.

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| WAREHOUSES(\*) | MO\_WH ⟵ σ(warehouse\_name='Missouri Warehouse')(WAREHOUSES) |
| WAREHOUSES(\*)  PRODUCT\_LOCATIONS(\*) | MO\_WH\_PROD ⟵ MO\_WH⨝warehouse\_id=wh\_idPRODUCT\_LOCATIONS |
| WAREHOUSES(\*)  PRODUCT\_LOCATIONS(\*) | MO\_WH\_PROD \_GR ⟵ σ(qty\_on\_hand > 0)(MO\_WH\_PROD) |
| PRODUCT\_LOCATIONS(prod\_id) | MO\_PROD\_RESULT ⟵ π(prod\_id)(MO\_WH\_PROD \_GR ) |
|  |  |
| WAREHOUSES(\*) | EC\_WH ⟵ σ(warehouse\_name='East Coast Warehouse')(WAREHOUSES) |
| WAREHOUSES(\*)  PRODUCT\_LOCATIONS(\*) | EC\_WH\_PROD ⟵ EC\_WH⨝warehouse\_id=wh\_idPRODUCT\_LOCATIONS |
| WAREHOUSES(\*)  PRODUCT\_LOCATIONS(\*) | EC\_WH\_PROD \_GR ⟵ σ(qty\_on\_hand > 0)(EC\_WH\_PROD) |
| PRODUCT\_LOCATIONS(prod\_id) | EC\_PROD\_RESULT ⟵ π(prod\_id)(EC\_WH\_PROD \_GR ) |
|  |  |
| PRODUCT\_LOCATIONS(prod\_id) | MO\_EC\_PL ⟵ MO\_PROD\_RESULT ⋂ EC\_PROD\_RESULT |
| WAREHOUSES(\*)  PRODUCT\_LOCATIONS(\*)  PRODUCTS(\*) | MO\_EC\_PRODS ⟵ MO\_EC\_PL⨝prod\_id=product\_idPRODUCT |
| PRODUCTS(product\_name) | RESULT ⟵ π(product\_name)(MO\_EC\_PRODS) |

List the products that are stored at both the Missouri Warehouse and the East Coast Warehouse.

1. List the supplier name for any supplier that has supplied two or more different products to the guitar shop. It does not matter if the products are currently in inventory or not.

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| PRODUCTS(supplier\_id, num\_products) | PROS\_NUM⟵ ρ(supplier\_id, num\_products)(supplier\_id ℑCOUNT(\*)(PRODUCTS)) |
| PRODUCTS(\*) | SUPS⟵ σ (num\_products≥2)(PROS\_NUM) |
| PRODUCTS(\*)  SUPPLIERS(\*) | PRO\_SUP ⟵ SUPS⨝supplier\_id= supplier\_idSUPPLIERS |
| SUPPLIERS(suppliers\_name) | RESULT⟵ π(supplier\_name)( PRO\_SUP) |

1. Using the minus operator, list the first and last names of any customer that has never placed an order. You may ***not*** use an outer join in your answer.

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| CUSTOMERS(customer\_id) | RESULT1⟵ π(customer\_id)(CUSTOMERS) |
| ORDERS (customer\_id) | RESULT2⟵ π(customer\_id)(ORDERS) |
| CUSTOMERS(customer\_id) | RESULT3⟵ RESULT1-RESULT2 |
| CUSTOMERS(\*) | RESULT4⟵RESULT3⨝customer\_id= customer\_id CUSTOMERS |
| CUSTOMERS(first\_name, last\_name) | RESULT⟵ π(first\_name,last\_name)(RESULT4) |

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