```
nodeID(25) Filter ((((isnotnull(cd_gender#42) AND isnotnull(cd_education_status#44)) AND (cd_gender#42 = F)) AND (cd_education_status#44 = Unknown)) AND isnotnull(cd_demo_sk#41))
nodeID(22) FileScan parquet tpcds_500_parquet.catalog_sales[cs_sold_date_sk#7,cs_bill_customer_sk#10,cs_bill_cdemo_sk#11,cs_item_sk#22,cs_quantity#25,cs_list_price#27,cs_sales_price#28,cs_coupon_amt#34,cs_net_profit#40
                                                             nodeID(21) Filter (((isnotnull(cs_bill_cdemo_sk#11) AND isnotnull(cs_bill_customer_sk#10)) AND i
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 nodeID(31) FileScan parquet tpcds_500_parquet.customer[c_customer_sk#50,c_current_cdemo_sk#52,c_current_addr_sk#54,c_birth_month#62,c_birth_year#63
                                                                                                                                                                                                                                                                                                                                                                                                                                                 nodeID(20) BroadcastHashJoin [cs_bill_cdemo_sk#11], [cd_demo_sk#41], Inner, BuildRight, false
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            nodeID(30) Filter (((c_birth_month#62 IN (1,6,8,9,12,2) AND isnotnull(c_customer_sk#50)) AND isnotnull(c_current_cdemo_sk#52)) AND isnotnull(c_current_addr_sk#54))
                                                                                                                                                                                                                                                                                                                                                                       nodeID(19) Project [cs_sold_date_sk#7, cs_bill_customer_sk#50, cs_current_cdemo_sk#52, cs_current_sk#50, cs_current_sk#5
                                                                                                                                                                                                                                                                                                                                                                                                                                                  nodeID(18) Exchange hashpartitioning(cs_bill_customer_sk#10, 200), ENSURE_REQUIREMENTS, [plan_id=142]
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            nodeID(28) Exchange hashpartitioning(c_customer_sk#50, 200), ENSURE_REQUIREMENTS, [plan_id=143]
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           nodeID(27) Sort [c_customer_sk#50 ASC NULLS FIRST], false, 0
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         nodeID(17) Sort [cs_bill_customer_sk#10 ASC NULLS FIRST], false, 0
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         nodeID(34) FileScan parquet tpcds_500_parquet.customer_demographics[cd_demo_sk#131
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      nodeID(16) SortMergeJoin [cs_bill_customer_sk#10], [c_customer_sk#50], Inner
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        nodeID(33) Filter isnotnull(cd_demo_sk#131)
                                                                                                                                                                                                                                                                                                                                                                                                           nodeID(15) Project [cs_sold_date_sk#7, cs_item_sk#22, cs_quantity#25, cs_list_price#27, cs_sales_price#28, cs_coupon_amt#34, cs_net_profit#40, cd_dep_count#47, c_current_addr_sk#54, c_birth_year#63]
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           nodeID(38) FileScan parquet tpcds_500_parquet.customer_address[ca_address_sk#68,ca_county#75,ca_state#76,ca_country#78
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  nodeID(14) BroadcastHashJoin [c_current_cdemo_sk#52], [cd_demo_sk#131], Inner, BuildRight, false
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             nodeID(13) Project [cs_sold_date_sk#7, cs_item_sk#22, cs_quantity#25, cs_list_price#27, cs_sales_price#28, cs_coupon_amt#34, cs_net_profit#40, cd_dep_count#47, c_current_addr_sk#54, c_birth_year#63] nodeID(37) Filter (ca_state#76 IN (MS,IN,ND,OK,NM,VA) AND isnotnull(ca_address_sk#68))
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               nodeID(42) FileScan parquet tpcds_500_parquet.date_dim[d_date_sk#81,d_year#87
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     nodeID(12) Exchange hashpartitioning(c_current_addr_sk#54, 200), ENSURE_REQUIREMENTS, [plan_id=154]
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  nodeID(11) Sort [c_current_addr_sk#54 ASC NULLS FIRST], false, 0
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          nodeID(35) Sort [ca_address_sk#68 ASC NULLS FIRST], false, 0
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              nodeID(41) Filter ((isnotnull(d_year#87) AND (d_year#87 = 1998)) AND isnotnull(d_date_sk#81))
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             nodeID(10) SortMergeJoin [c_current_addr_sk#54], [ca_address_sk#68], Inner
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     nodeID(40) Project [d_date_sk#81]
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  nodeID(45) FileScan parquet tpcds_500_parquet.item[i_item_sk#109,i_item_id#110
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     nodeID(9) Project [cs_sold_date_sk#7, cs_item_sk#22, cs_quantity#25, cs_list_price#27, cs_sales_price#28, cs_coupon_amt#34, cs_net_profit#40, cd_dep_count#47, c_birth_year#63, ca_country#78] nodeID(39) BroadcastExchange HashedRelationBroadcastMode(List(cast(input[0, int, true] as bigint)), false), [plan_id=161]
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         nodeID(8) BroadcastHashJoin [cs_sold_date_sk#7], [d_date_sk#81], Inner, BuildRight, false
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      nodeID(44) Filter isnotnull(i_item_sk#109)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   nodeID(7) Project [cs_item_sk#22, cs_quantity#25, cs_list_price#27, cs_sales_price#28, cs_coupon_amt#34, cs_net_profit#40, cd_dep_count#47, c_birth_year#63, ca_county#75, ca_state#76, ca_country#78] nodeID(43) BroadcastExchange HashedRelationBroadcastMode(List(cast(input[0, int, false] as bigint)),false), [plan_id=165]
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    nodeID(6) BroadcastHashJoin [cs_item_sk#22], [i_item_sk#109], Inner, BuildRight, false
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                nodeID(5) Project [cs_quantity#25, cs_list_price#27, cs_sales_price#28, cs_coupon_amt#34, cs_net_profit#40, cd_dep_count#47, c_birth_year#63, i_item_id#110, ca_country#78, ca_state#76, ca_country#75]
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 node ID(4) Expand [[cs_quantity#25, cs_list_price#27, cs_sales_price#28, cs_coupon_amt#34, cs_net_profit#40, cd_dep_count#47, c_birth_year#63, i_item_id#110, rall, null, nul
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          nodeID(3) HashAggregate(keys=[i_item_id#159, ca_country#160, ca_state#161, ca_country#160, ca_st
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        nodeID(2) Exchange hashpartitioning(i_item_id#159, ca_country#160, ca_state#161, ca_county#162, spark_grouping_id#158L, 200), ENSURE_REQUIREMENTS, [plan_id=171]
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       nodeID(1) HashAggregate(keys=[i_item_id#159, ca_country#160, ca_state#161, ca_country#160, ca_state#161, ca_country#160, ca_state#161, ca_country#160, as decimal(12,2))), avg(cast(cs_net_profit#40 as decima
```

nodeID(26) FileScan parquet tpcds_500_parquet.customer_demographics[cd_demo_sk#41,cd_gender#42,cd_education_status#44,cd_dep_count#47