Consider the **global relational schema**:

DOCTOR (<u>DNUM</u>, NAME, DEPT)
PATIENT (<u>PNUM</u>, NAME, DEPT, TREAT, DNUM)
CARE (PNUM, DRUG, QUAN)

Given the following **fragmentation schema**:

$DOCTOR_1 = SL_{DEPT = "SURGERY"} \; DOCTOR$
$DOCTOR_2 = SL_{DEPT = "PEDIATRICS"} \; DOCTOR$
$DOCTOR_3 = SL_{DEPT \neq "SURGERY" \; AND \; DEPT \neq "PEDIATRICS"} \; DOCTOR$

$PATIENT_1 = SL_{DEPT = "SURGERY" \; AND \; TREAT = "INTENSIVE"} \; PATIENT$
$PATIENT_2 = SL_{DEPT = "SURGERY" \; AND \; TREAT \neq "INTENSIVE"} \; PATIENT$
$PATIENT_3 = SL_{DEPT \neq "SURGERY"} \; PATIENT$

$CARE_1 = CARE \; SJ_{PNUM = PNUM} \; PATIENT_1$
$CARE_2 = CARE \; SJ_{PNUM = PNUM} \; PATIENT_2$
$CARE_3 = CARE \; SJ_{PNUM = PNUM} \; PATIENT_3$

Assume that a patient is always assigned to the same department as his or her doctor. Attribute **DNUM** and **PNUM** indicates *Doctor Number* and *Patient Number* respectively.

Applications:

$APP1 =$ $PJ_{TREAT, \; DOCTOR.NAME} \, ((SL_{DEPT = "SURGERY"} \; DOCTOR \; NJN \; SL_{DEPT = "PEDIATRICS"}$
$PATIENT) \; NJN \; ((SL_{DEPT = "SURGERY"} \; DOCTOR \; NJN \; PATIENT) \; UN$
$((SL_{TREAT = "INTENSIVE"} \; PATIENT \; NJN \; SL_{DEPT = "SURGERY"} \; DOCTOR) \; DF$
$(SL_{DEPT = "SURGERY"} \; (PATIENT \; NJN \; DOCTOR)))))$

For **APP1**, draw the *operator tree*. Perform step by step transformations to *simplify the operator tree*, indicating which rule and criterion is applied at each step. Transform the simplified query into fragment query by applying *canonical expression*. Write the equivalent query obtained from the tree.