The following relation schema is given:

```
EMPLOYEE(ENR, ENAME, JOB, SALARY)
PROJECT(PNR, PNAME, BUDGET)
ASSIGNMENT(ENR, PNR, DURATION)
```

1. Normalization

What is the disjunctive and conjunctive normal form for the WHERE-condition of the following query:

```
SELECT * FROM EMPLOYEE
WHERE (ENAME LIKE 'M%' AND JOB='Administrator')
OR ((ENR>550 OR JOB='SW-Developer') AND SALARY<80.000)
```

2. Simplification

Simplify the selection condition of the following query:

```
SELECT * FROM EMPLOYEE
WHERE ENR>456 AND
NOT (JOB='Administrator' OR SALARY<50.000) AND
JOB<>'Administrator' AND SALARY<50.000
```

3. Operator Tree and Fragment Expression

Transform the following query to relational algebra and perform algebraic optimizations:

```
SELECT ENAME, PNAME
FROM EMPLOYEE P, PROJECT PT, ASSIGNMENT PM
WHERE DURATION>10 AND P.ENR=PM.ENR AND
JOB='SW-Developer' AND PT.PNR=PM.PNR
```
4. Data Localization)

The following horizontal fragmentation for PROJECT is given:

\[
\begin{align*}
\text{PROJECT}_1 &= \sigma_{\text{BUDGET}<100,000}(\text{PROJECT}) \\
\text{PROJECT}_2 &= \sigma_{100,000 \leq \text{BUDGET} \leq 800,000}(\text{PROJECT}) \\
\text{PROJECT}_3 &= \sigma_{\text{BUDGET}>800,000}(\text{PROJECT})
\end{align*}
\]

ASSIGNMENT has an according derived fragmentation:

\[
\begin{align*}
\text{ASSIGNMENT}_1 &= \text{ASSIGNMENT} \bowtie \text{PROJECT}_1 \\
\text{ASSIGNMENT}_2 &= \text{ASSIGNMENT} \bowtie \text{PROJECT}_2 \\
\text{ASSIGNMENT}_3 &= \text{ASSIGNMENT} \bowtie \text{PROJECT}_3
\end{align*}
\]

Transform the following query to relational algebra and create the initial fragment expressions by inserting the reconstruction expression. Perform algebraic optimization to improve the fragment expression.

```
SELECT ENR
FROM PROJECT PT, ASSIGNMENT PM
WHERE DURATION>10 AND BUDGET>1,000,000
AND PT.PNR=PM.PNR
```

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