Soluzione

```sql
CREATE TABLE CORSI
    (C_IdCorso NUMBER(5,0),
     C_Nome VARCHAR2(20 BYTE),
      C_Crediti NUMBER(5,0),
       PRIMARY KEY (C_IdCorso)
);

CREATE TABLE STUDENTI
    (S_Mat NUMBER(5,0),
     S_Nome VARCHAR2(20 BYTE),
       S_Cognome VARCHAR2(20 BYTE),
       PRIMARY KEY (S_Mat)
);


CREATE TABLE ESAMI
    (
     E_Mat NUMBER(5,0),
       E_Corso NUMBER(5,0),
       E_Voto NUMBER(5,0),
       E_Data DATE,
       PRIMARY KEY (E_Mat,E_Corso,E_Data),
       FOREIGN KEY (E_Mat) REFERENCES STUDENTI (S_Mat),
       FOREIGN KEY (E_Corso) REFERENCES CORSI (C_IDCorso)
  );




create or replace procedure StampaIstogrammaVoti(vIdCorso number, vCum boolean)
is

cursor curVoti is
    Select
 (CASE
  WHEN E_Voto < 18 THEN 'F'
  WHEN E_Voto < 21 THEN 'E'
  WHEN E_Voto < 24 THEN 'D'
  WHEN E_Voto < 27 THEN 'C'
  WHEN E_Voto < 30 THEN 'B'
  ELSE 'A'
 END) as rvoto , count(*) as NUM
  from ESAMI
  where E_Corso=vIdCorso
  group by ( CASE
  WHEN E_Voto < 18 THEN 'F'
  WHEN E_Voto < 21 THEN 'E'
  WHEN E_Voto < 24 THEN 'D'
  WHEN E_Voto < 27 THEN 'C'
  WHEN E_Voto < 30 THEN 'B'
  ELSE 'A'
 END)
  order by 1 desc;

vPrev number;
begin
vPrev:=0;
if vCum then
    for vVoti in curVoti loop
        dbms_output.put_line('Range: '||vVoti.RVoto ||' numero: '|| vVoti.Num);
```

```plsql
        end loop;
else
        for vVoti in curVoti loop
              vPrev:=vPrev+vVoti.Num;
           dbms_output.put_line('Range: '||vVoti.RVoto ||' numero: '|| vPrev );
        end loop;

end if;
end;
```

```
SELECT  P_NAME, sum(L_QUANTITY)
FROM    TPCD.PART,TPCD.LINEITEM
WHERE   P_PARTKEY=L_PARTKEY AND P_TYPE='STANDARD PLATED COPPER'
        AND L_SHIPMODE='RAIL'
GROUP BY P_PARTKEY, P_NAME;
```

OPERATION	OBJECT_NAME	CARDINALITY
⊟── ● SELECT STATEMENT		5771
⊟──⬆ SORT (GROUP BY)		5771
⊟──▦ TABLE ACCESS (BY INDEX ROWID)	LINEITEM	4
⊟──⊙▼ Filter Predicates		
⋮── L_SHIPMODE='RAIL'		
⊟──▷◁ NESTED LOOPS		5771
⊟──▦ TABLE ACCESS (FULL)	PART	1333
⊟──⊙▼ Filter Predicates		
⋮── P_TYPE='STANDARD PLATED COPPER'		
⊟──▢ INDEX (RANGE SCAN)	IX_PART_LI	30
⊟──⊙ Access Predicates		
⋮── P_PARTKEY=L_PARTKEY		

$NP_{PART} = \lceil 200{,}000 \times 133/ (4096 \times 0{,}69) \rceil = 9{,}412$

$NP_{LINEITEM} = \lceil 6{,}001{,}215 \times 116/ (4096 \times 0{,}69) \rceil = 246{,}314$

$\texttt{Sel}_{(P\_TYPE=\ldots)} = 1/150$

$NL_{(L\_PARTKEY)} = \lceil (200{,}000 \times 4 + 6{,}001{,}215 \times 4)/ (4096 \times 0{,}69) \rceil = 8{,}777$

Accesso a LI = $2 + \lceil 1/200{,}000 \times 8{,}777 \rceil + \Phi(6{,}001{,}215/200{,}000; 246{,}314) = 33$

Costo Join Part+Lineitem = $9{,}412 + 1/150 \times 200{,}000 \times 33 = \textbf{53{,}412}$

$\texttt{Sel}_{(L\_SHIPMODE=\ldots)} = 1/7$

$NT_{P\text{-}LI} = \lceil 6{,}001{,}215 \times 1/7 \times 1/150 \rceil = 5{,}716$

$NP_{P\text{-}LI} = \lceil 5{,}716 \times (116+133) / (4096 \times 0{,}69) \rceil = 504$

Costo del group by $2 \times 504 \times (\lceil \log_{100} 504 \rceil + 1) = \textbf{3{,}024}$

Costo Totale = 53,412 + 3,024 = 56,436

Sarà considerata valida anche la soluzione in cui

$\Phi(6{,}001{,}215/200{,}000; 246{,}314) = 33$ per un costo totale di 57,770

La selezione su L_SHIPMODE sia applicata dopo il join e venga eseguita assieme al GB