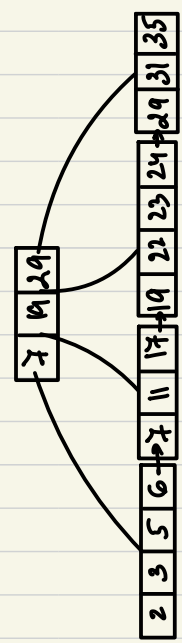
## Task 1.

1. $\Pi_{Fname, Lname}(Employee \bowtie_{Ssn=Essn \text{ and } Dependent\_name=Fname} (Dependent))$
2. $\Pi_{Fname, Lname}(\rho_{E1}(Employee)) \bowtie_{E1.Super\_ssn=E2.Ssn} (\sigma_{E2.Fname='James' \text{ and } E2.Lname='Borg'}(\rho_{E2}(Employee)))$
3. $\Pi_{Fname, Lname}(\sigma_{Dno=5}(Employee) \bowtie_{Ssn=Essn} ((\sigma_{Pname='ProjectX'}(Project)) \bowtie_{Pnumber=Pno} (\sigma_{Hours>10}(Works\_On))))$
4. $\Pi_{Pname, total\_hours}\ \gamma_{Pnumber, Pname;\ SUM(Hours)\rightarrow total\_hours}(Project \bowtie_{Pnumber=Pno} Works\_On)$
5. $[\Pi_{Fname, Lname}(Employee \bowtie_{Ssn=Essn}(Works\_On))] \div [\Pi_{Pno}(\rho_{Pno \leftarrow Pnumber}(Project))]$
6. $(\Pi_{Fname, Lname}(Employee)) - (\Pi_{Fname, Lname}(Employee \bowtie_{Ssn=Essn}(Works\_On)))$
7. $\Pi_{Dname, avg\_salary}\ \gamma_{Dnumber, Dname;\ AVG(Salary)\rightarrow avg\_salary}(Employee \bowtie_{Dno=Dnumber} Department)$
8. $\Pi_{avg\_salary}\ \gamma_{;\ AVG(Salary)\rightarrow avg\_salary}\ \sigma_{Sex='M'}\ Employee$
9. $(\Pi_{Fname, Lname, Address}(Employee \bowtie_{Ssn=Essn}((\sigma_{Plocation='Stafford'}(Project)) \bowtie_{Pnumber=Pno} Works\_on)) - (\Pi_{Fname, Lname, Address}(Employee \bowtie_{Dno=Dnumber}(Department \bowtie (\sigma_{Dlocation='Stafford'}(Dept\_Locations))))$
10. $\Pi_{E2.Lname}(\sigma_{Dependent\_name=null}((\rho_{E1}(Employee)) \bowtie_{E1.Super\_ssn=E2.Ssn} (\rho_{E2}(Employee))) \bowtie_{E2.Ssn=Essn} (Dependent)))$

## Task 2.

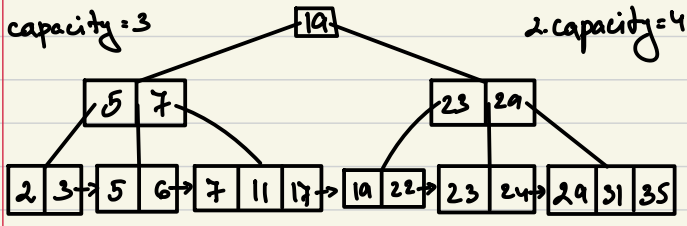
$B = 512B$ $G = 128B$ $N_t^b = 20$ $N_d^t = 400$ $pack = 30d$

1. $C_{total}^{track} = (B+G)N_t^b = 12.8$ kB
   $C_{useful}^{track} = BN_t^b = 10.24$ kB
2. $N_{cylinder} = N_{tracks} = 400$
3. $C_{total}^{cyl} = (B+G)N_t^b\ pack = 384$ kB
   $C_{useful}^{cyl} = BN_t^b\ pack = 307.2$ kB
4. $C_{total} = (B+G) \times N_t^b \times N_d^t \times pack = 153.6$ MB
   $C_{useful} = B \times N_t^b \times N_d^t \times pack = 122.88$ MB




## Task 3

1. capacity = 3




2. capacity = 4