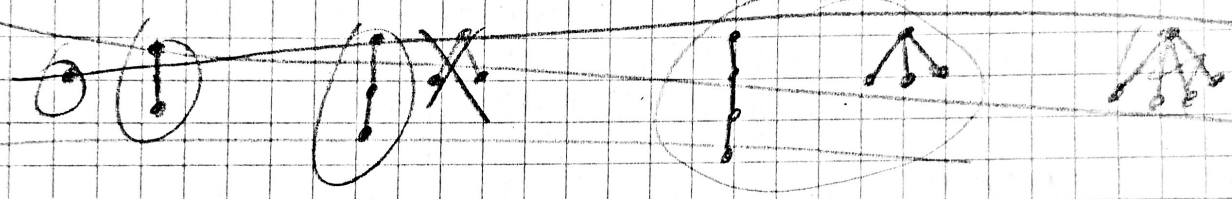
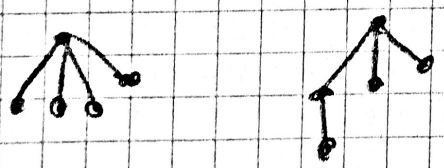
1)



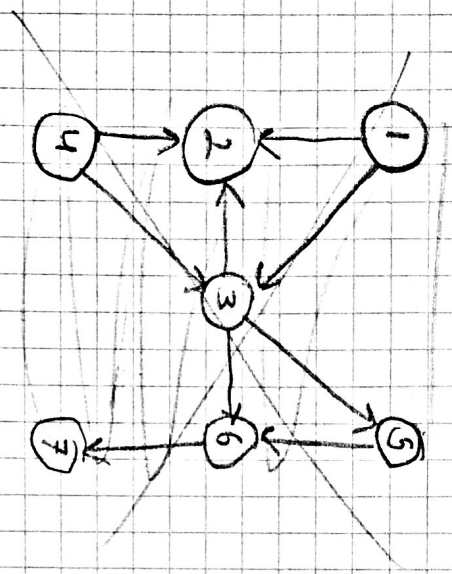
a)

b)



2)

bijeksjonen gir ikke en isomorfi fordi f.eks. (e→p) skal ha kanter til (a→k) og (b→l).



3) nei, fordi (e→o) eller (e→p) må ha to nabohjørnor som også er naboer.

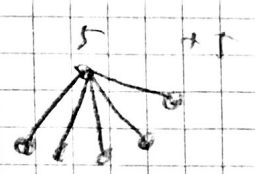
4) a)

~~fordi en vrengt genser fortsatt er den samme genseren?~~

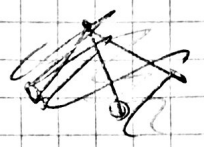
fordi to objekter kan være essensielt det samme uten å være helt likt.

b) nei, det bør tas hensyn til negative tall f.eks. ved bruk av abs-verdi.

5) a)

- tre med 
  6 hjørner

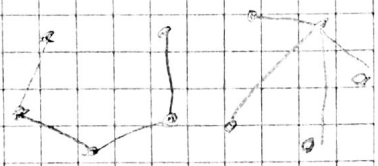
=> 6 - 1 = 5 kanter



=> 5 · 2 $\overset{\text{total}}{=}$ grad 10

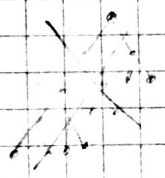
totalgrad 12 eksisterer ikke

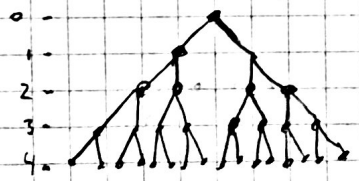
b) 5 hjørner, 4 kanter.



eksisterer ikke fordi 4 kanter er nok til å gjøre grafen sammenhengende, men manglerer kant for å lukke den.

c)

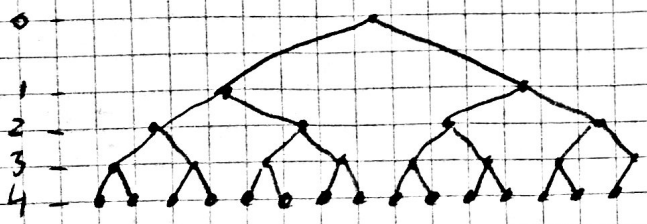




maks løv-hjørner med høyde 4 i binærtre

- $= 2^4 = 16 < 18$ => eksisterer ikke

d)



6)

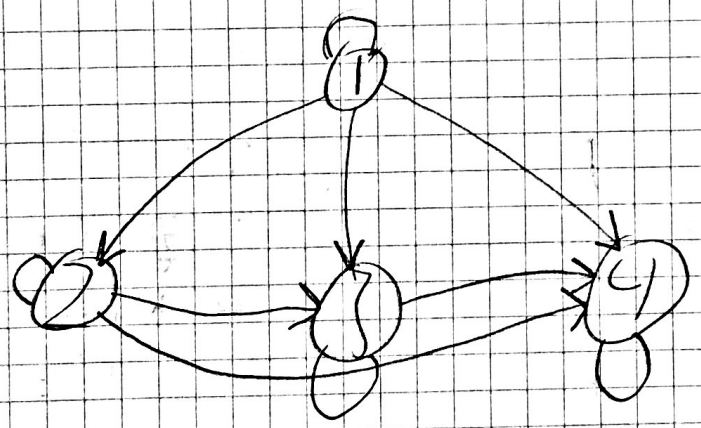
a) - refleksiv fordi hvert element er lik seg selv.

- ikke symmetrisk fordi $1 \leq 2$ men $2 \not\leq 1$

- transitiv fordi $(1 \leq 2$ og $2 \leq 3$ og $1 \leq 3)$ og $(2 \leq 3$ og $3 \leq 4$ og $2 \leq 4)$

- nei, fordi den er ikke symmetrisk.

$\{(1,1)(1,2),(1,3),(1,4),(2,3),(2,4),(2,2),(3,3),(3,4),(4,4),(\emptyset,\emptyset)\}$

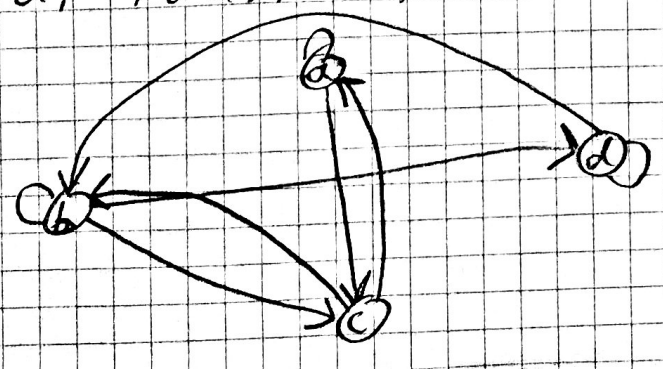


b) - ikke refleksiv fordi (c,c) mangler

- symmetrisk fordi $\forall (x,y) \in M \; \exists (x,y) \in R_2$

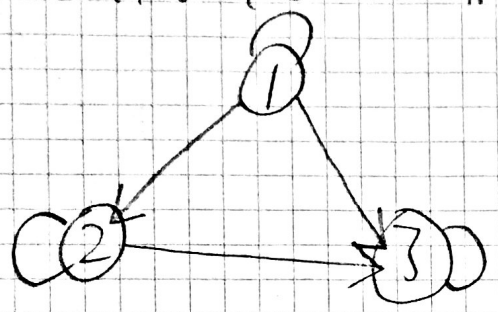
- ikke transitiv fordi (a,c) og (c,b) eksisterer, men ikke (a,b)

- nei; fordi relasjonen er ikke refleksiv.



c) $R_3 = \{(\emptyset), (1,1), (2,2), (3,3), (1,2), (1,3), (2,3)\}$

- refleksiv fordi grafen er rettet
- usymmetrisk fordi $(1,2) \in R_3$, men ikke $(2,1)$
- ikke transitiv fordi R_3 er usymmetrisk



7) I) ikke refleksiv fordi $(b,b) \notin R$

=> ikke Partiell

II) - refleksiv fordi $\forall x \in R \ \exists (x,x)$

- antisymmetrisk fordi $(a,b) \in R$, men ikke (b,a)
- transitiv fordi $\forall (X,Y,Z) \in R$ der $\exists (X,Y) \wedge (Y,Z)$

$\exists (X,Z)$

Partielle ordninger fordi de 3 kravene er oppfylt.

(ii) - refleksiv

- antisymmetrisk

- transitiv

partiell fordi kravene oppfylles.

7b) - refleksiv fordi $\forall x \in R \; \exists (x, x)$

fordi $x^2 = x^2$ fordi $M = N$

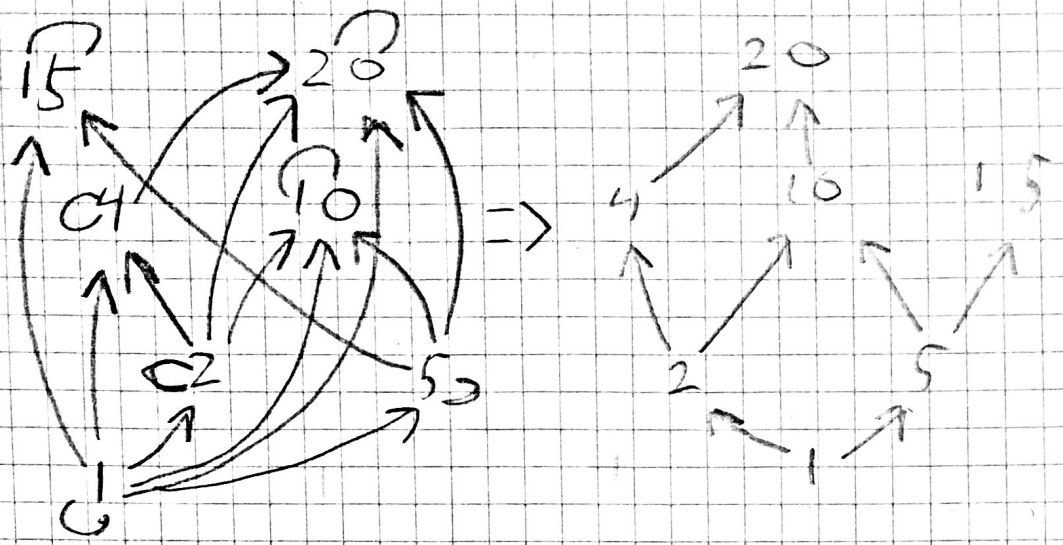
- antisymmetrisk fordi $m \leq n$, men ikke motsatt
- transitiv fordi $x^2 \leq y^2 \equiv x \leq y$

$\Rightarrow$ grafen er retta

Partiell ordning fordi kriteriene oppfylles.

8) a) $A = \{1, 2, 4, 5, 10, 15, 20\}$

I)



II) maks: 20, 15 min: 1 (alle loopene)

Største element: $\emptyset$

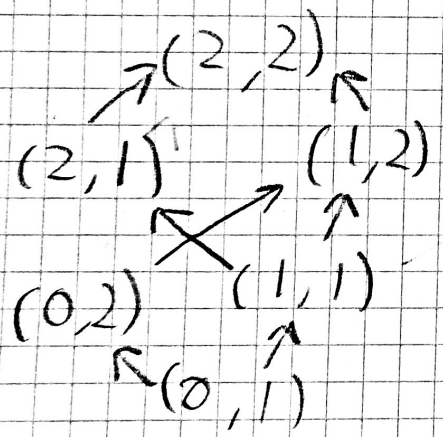
minste element: 1

III) fordi 20 og 15 ikke har noe relasjon.

- 1, 5, 15, 2, 4, 10, 20
- 1, 2, 4, 5, 10, 15, 20

8b) $S \times T = \{(0,1),(0,2),(1,1),(1,2),(2,1),(2,2)\}$

i)



ii) maks: (2,2) min: (0,1)

største: (2,2) minst: (0,1)

iii) fordi ((2,1) og (1,2)) og ((0,2) og (1,1) ikke har noe relasjon

iv)

- (0,1), (1,1), (2,1), (0,2), (1,2), (2,2)
- (0,1), (0,2), (1,2), (1,1), (2,1), (2,2)