Exercise session: Relational Calculus

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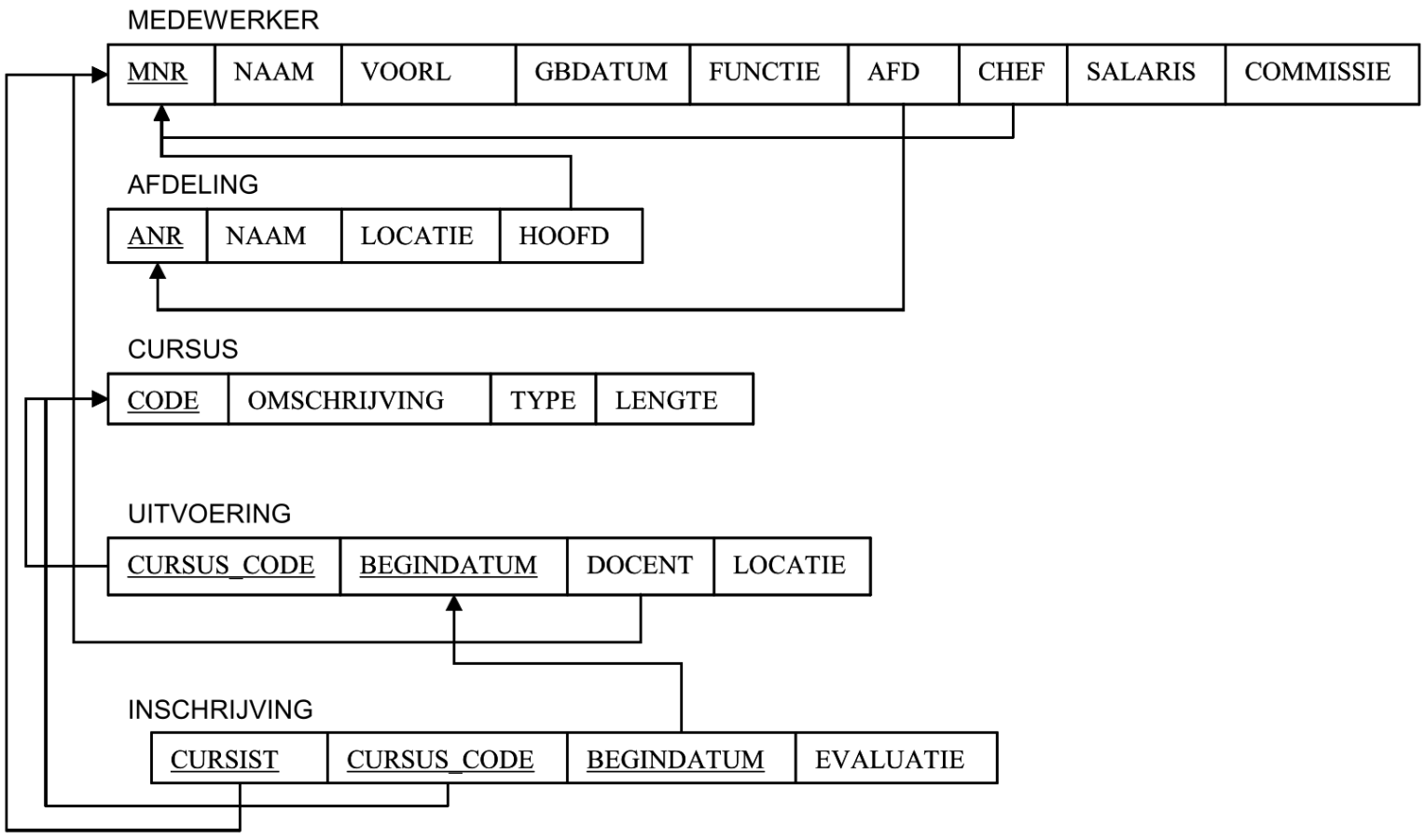
Question: Give, for each employee, the name, the function, and the name of the division for which he/she works

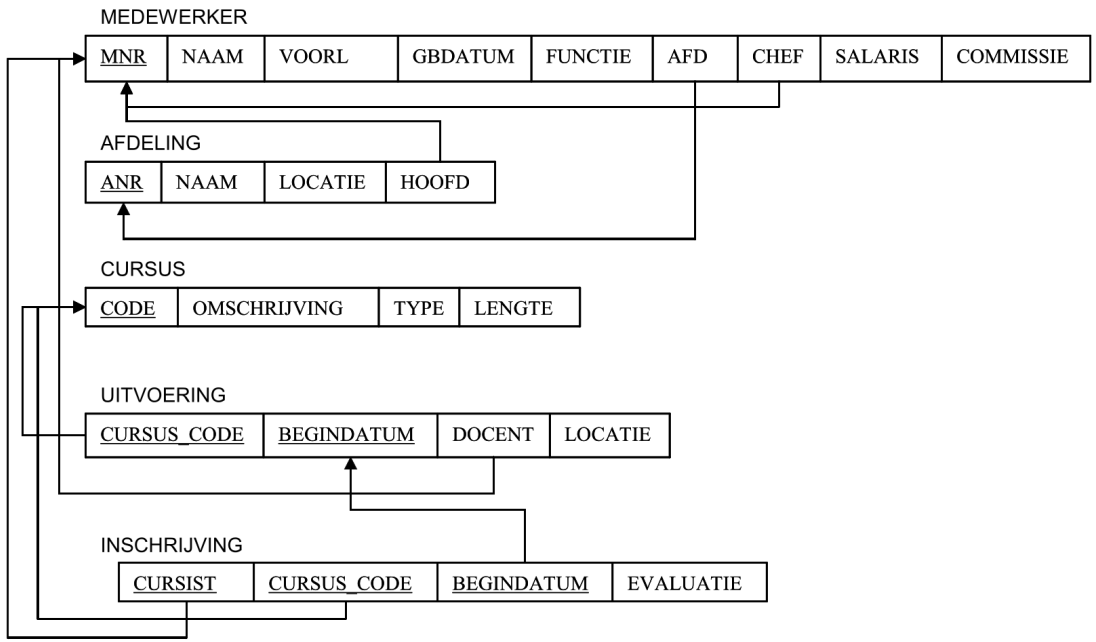


Question: Give, for each employee, the name, the function, and the name of the division for which he/she works

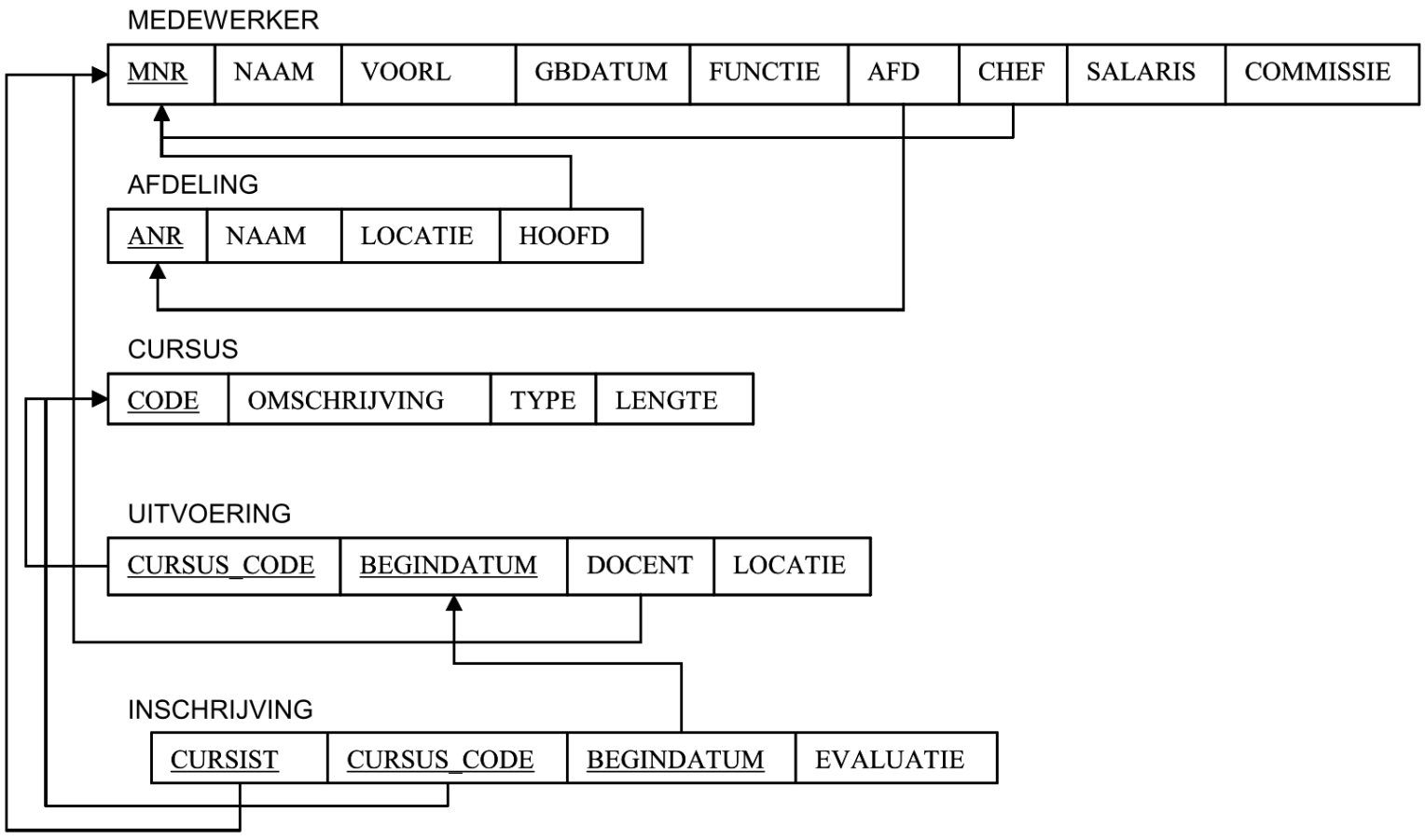
$$\{\ \text{m.NAME},\ \text{m.FUNCTION},\ \text{a.NAME}\ \mid\ \text{EMPLOYEE(m)}\ \text{and}\ \text{DIVISION(a)}\ \text{and}\ \text{m.DIV} = \text{a.DNR}\ \}$$

$$---$$

$$\{\ \text{b e k}\ \mid\ (\exists\ \text{f})\ (\text{EMPLOYEE(a b c d e f g h i)}\ \text{and}\ (\exists\ \text{j})\ (\text{DIVISION(j k l m)}\ \text{and}\ \text{j} = \text{f}\ ))\ \}$$



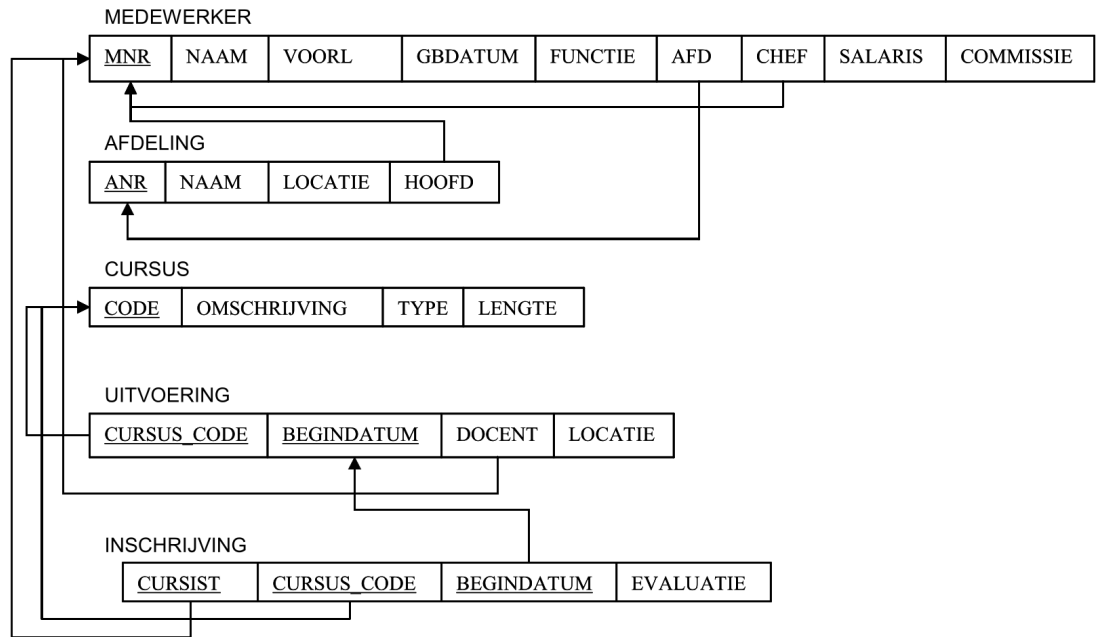
Question: Give the names of all employees that are subscribed for a course of type BLD.



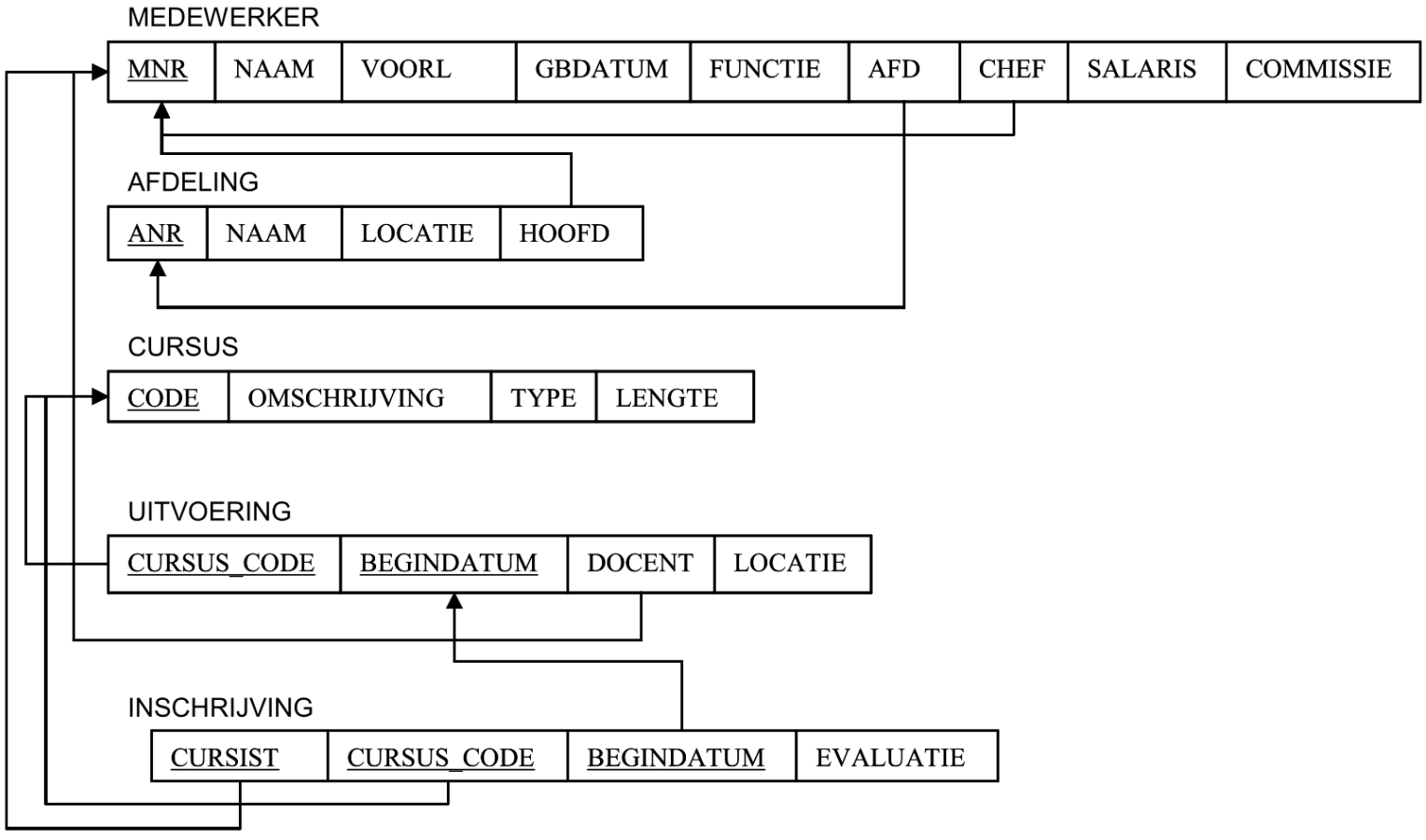
Question: Give the names of all employees that are subscribed for a course of type BLD.

$$\{m.NAME \mid EMPLOYEE(m) \text{ and } (\exists\, i)\ (REGISTRATION(i) \text{ and } i.PARTICIPANT = m.ENR \text{ and } (\exists\, c)\ (COURSE(c) \text{ and } c.CODE = i.COURSE\_CODE \text{ and } c.TYPE = \text{'BLD'}\ ))\}$$

$$\{b \mid (\exists\, a)\ (EMPLOYEE(a\ b\ c\ d\ e\ f\ g\ h\ i) \text{ and } (\exists\, j)\ (\exists\, k)\ (REGISTRATION(j\ k\ l\ m) \text{ and } j = a \text{ and } (\exists\, r)\ (\exists\, t)\ (COURSE(r\ s\ t\ u) \text{ and } r = k \text{ and } t = \text{'BLD'}\ ))))\}$$



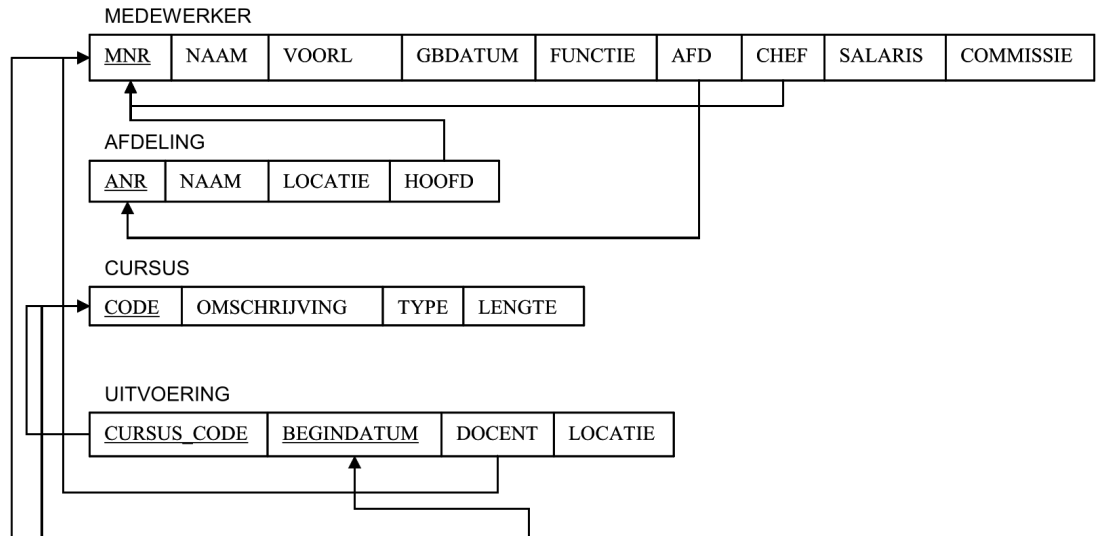
Question: Give the name of the employees that are themselves no boss, but that earn more than another employee who is a boss



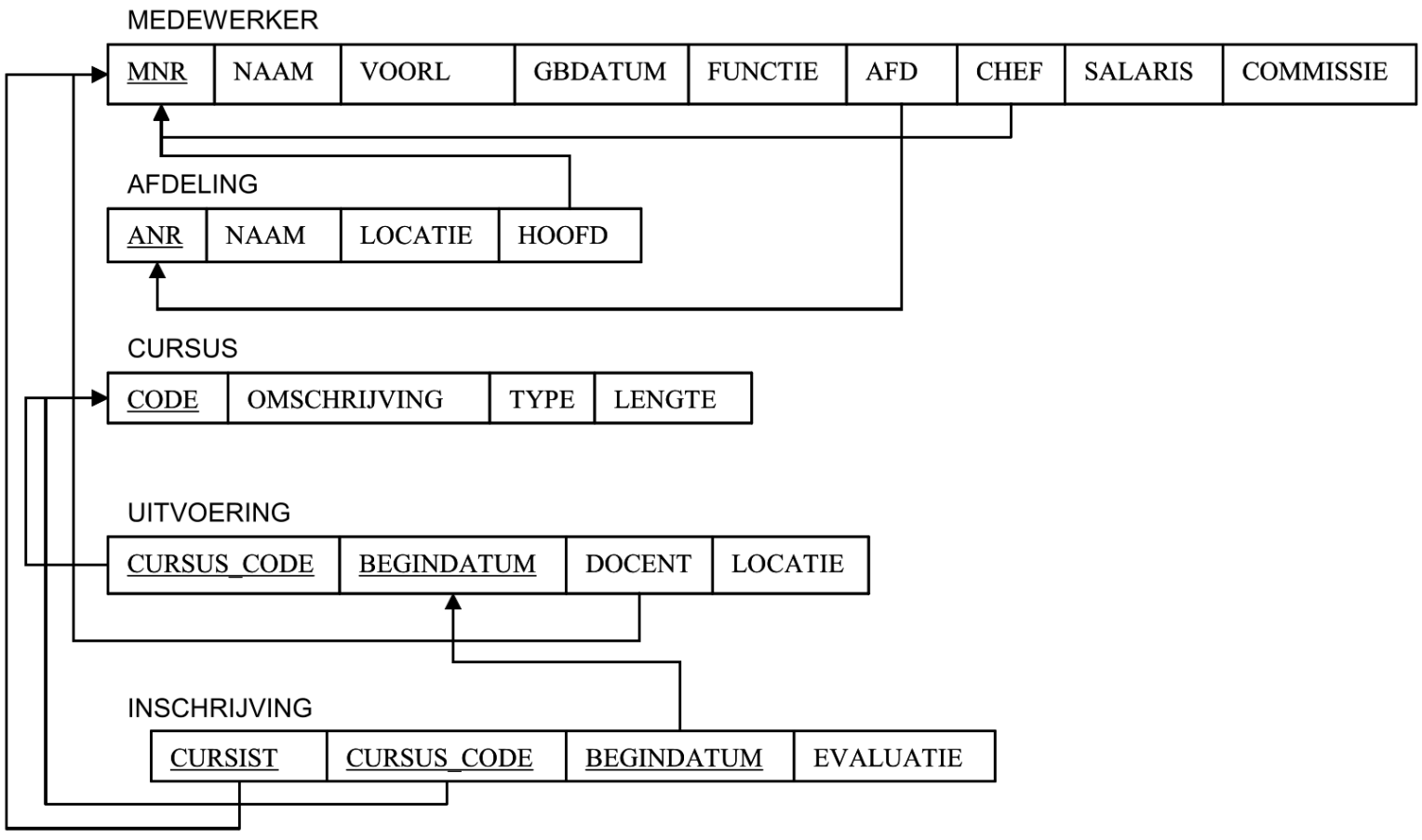
Question: Give the name of the employees that are not a boss, but that earn more than another employee who is a boss

$$\{m.NAME \mid EMPLOYEE(m) \text{ and not } (\exists\, n)\ (EMPLOYEE(n) \text{ and } n.BOSS = m.ENR) \text{ and } (\exists\, o)\ (EMPLOYEE(o) \text{ and } (\exists\, p)\ (EMPLOYEE(p) \text{ and } p.BOSS = o.ENR) \text{ and } m.SALARIS > o.SALARIS)\ \}$$

$$\{b \mid (\exists\, a)\ (\exists\, h)\ (EMPLOYEE(a\ b\ c\ d\ e\ f\ g\ h\ i) \text{ and not } (\exists\, p)\ (EMPLOYEE(j\ k\ l\ m\ n\ o\ p\ q\ r) \text{ and } p = a) \text{ and } (\exists\, j)\ (\exists\, q)\ (EMPLOYEE(j\ k\ l\ m\ n\ o\ p\ \text{[illegible]} \text{ and } (\exists\, y)\ (EMPLOYEE(s\ t\ u\ v\ w\ x\ y\ z\ \alpha) \text{ and } y = j) \text{ and } h > q\ ))\ \}$$



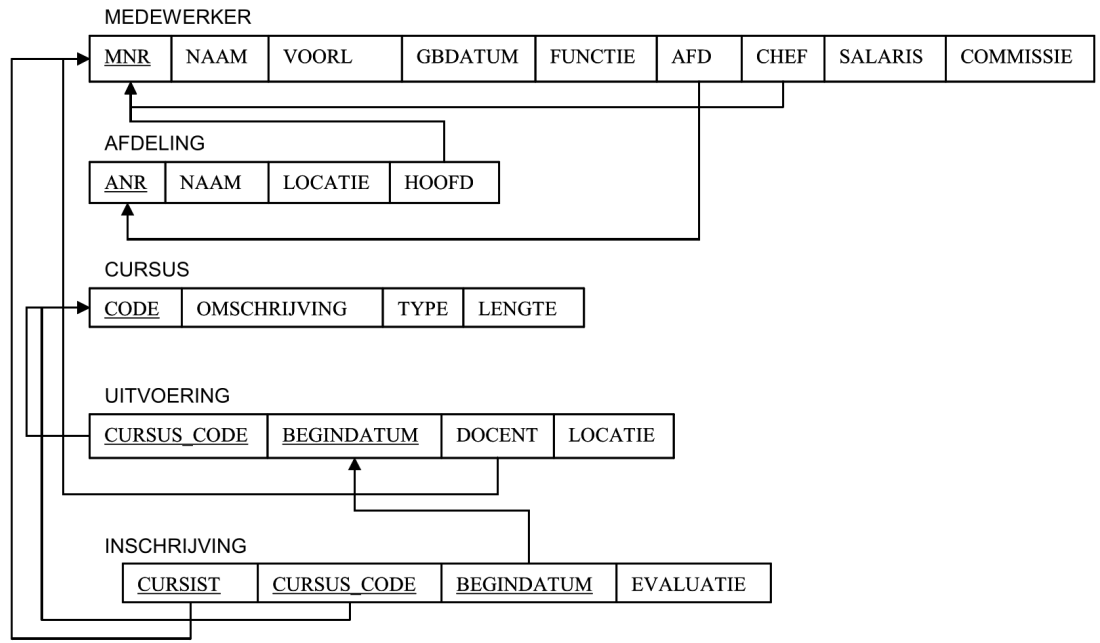
Question: Give the names of the employees who are registered for each course.



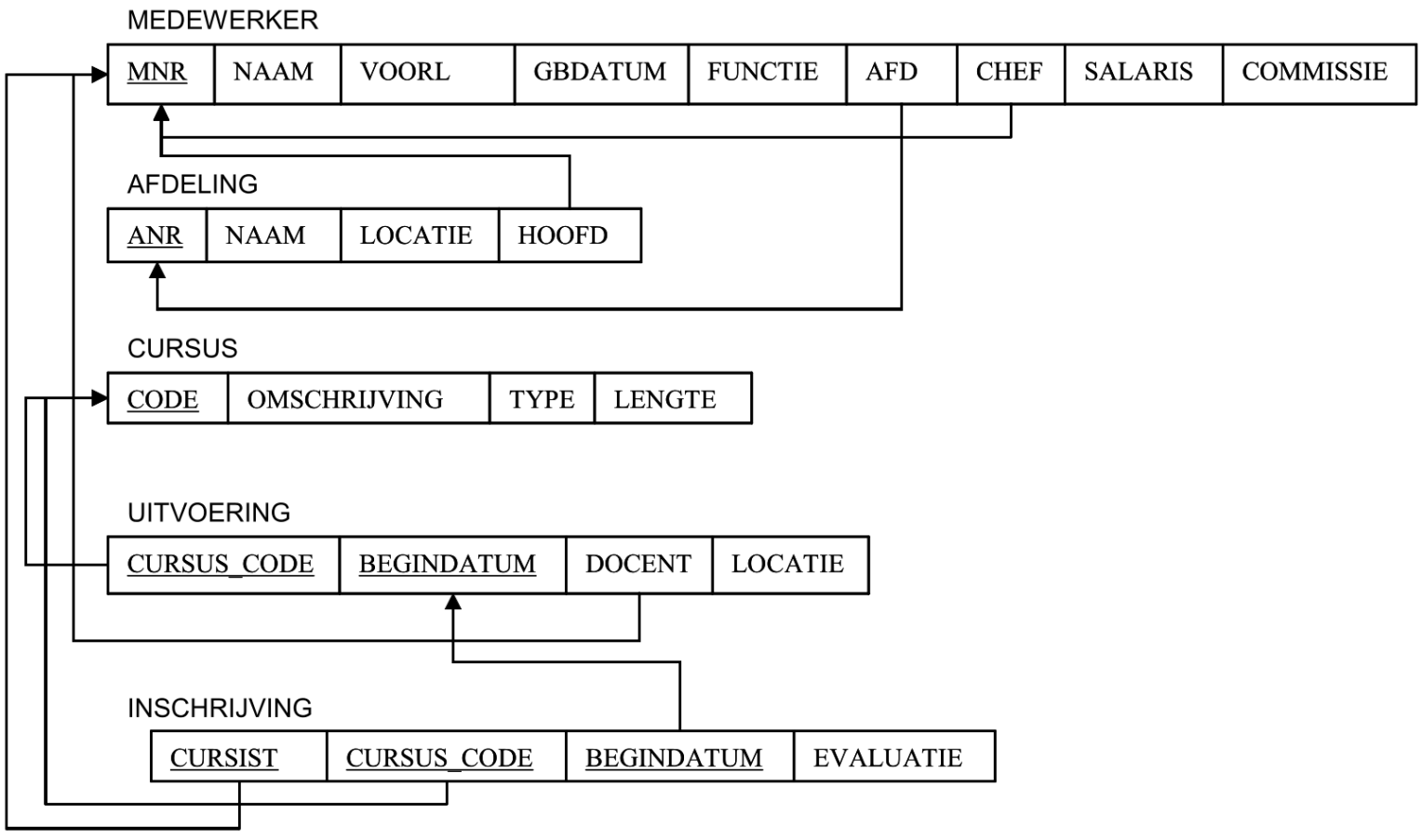
Question: Give the names of the employees who are registered for each course.

$$\{m.NAME \mid EMPLOYEE(m) \text{ and } (\forall c)\ (\text{not } COURSE(c) \text{ or } (\exists i)\ (REGISTRATION(i) \text{ and } i.COURSE\_CODE = c.CODE \text{ and } i.PARTICIPANT = m.ENR))\}$$

$$\{b \mid (\exists a)\ (EMPLOYEE(a\ b\ c\ d\ e\ f\ g\ h\ i) \text{ and } (\forall j)\ (\text{not } COURSE(j\ k\ l\ m) \text{ or } (\exists n)(\exists o)(REGISTRATION(n\ o\ p\ q) \text{ and } o = j \text{ and } n = a)))\ \}$$



Question: Give the code and description of the courses that are followed by all employees of a division

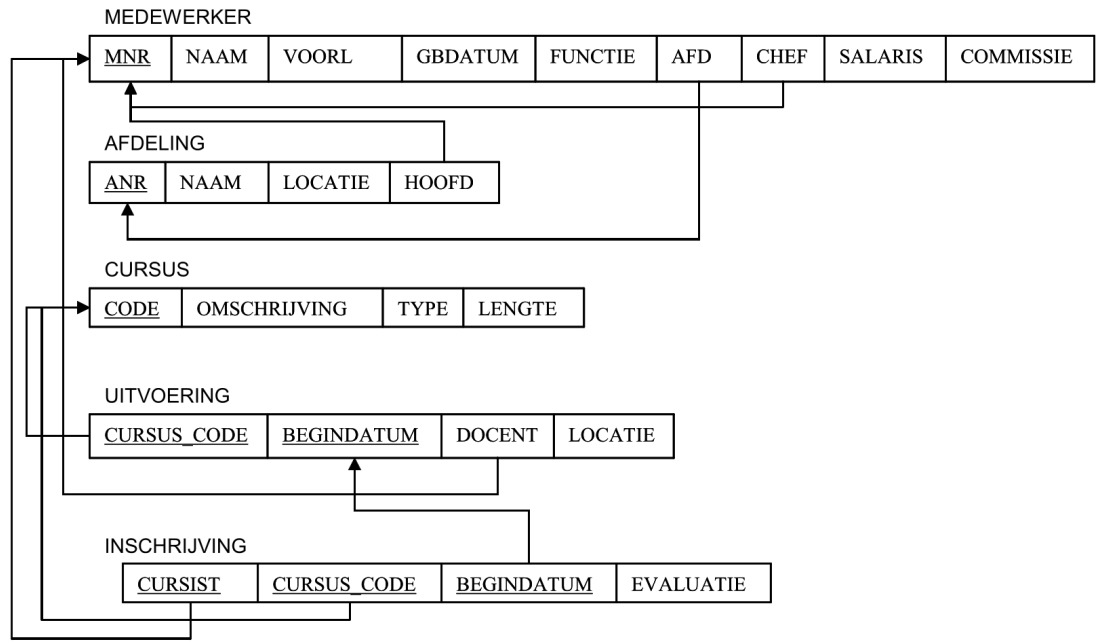


Question: Give the code and description of the courses that are followed by all employees of a division

$$\{c.\text{CODE}, c.\text{DESCRIPTION} \mid \text{COURSE}(c) \text{ and } (\exists a)(\text{DIVISION}(a) \text{ and } (\forall m)\ (\text{not EMPLOYEE}(m) \text{ or not } m.\text{DIV} = a.\text{DNR} \text{ or } (\exists i)\ (\text{REGISTRATION}(i) \text{ and } i.\text{PARTICIPANT} = m.\text{ENR} \text{ and } i.\text{COURSE\_CODE} = c.\text{CODE}\ ))))\}$$

———

$$\{a\ b \mid \text{COURSE}(a\ b\ c\ d) \text{ and } (\exists n)\ ((\forall i)\ (\text{not EMPLOYEE}(i\ j\ k\ l\ m\ n\ o\ p\ q) \text{ or } (\exists r)\ (\exists s)\ (\text{REGISTRATION}(r\ s\ t\ u) \text{ and } r = i \text{ and } s = a\ )))\}$$



Exercise 2: A

Question: Specify in relational calculus (domain and tuple calculus)

$$\sigma_{A=C}(R(A, B, C))$$

- σ – select
- $A = C$ constraint on the columns
- R is a relation with attributes A, B, C

Exercise 2: A

Question: Specify in relational calculus (domain and tuple calculus)

$$\sigma_{A=C}(R(A, B, C))$$

Answer:

$$\{\mathrm{r.A},\ \mathrm{r.B}, \mathrm{r.C} \mid (\mathrm{R(r)\ and\ r.A = r.C})\}$$

———

$$\{\mathrm{p\ q\ r} \mid \mathrm{R(p\ q\ r)\ and\ p = r}\}$$

Exercise 2: B

Question: Specify in relational calculus (domain and tuple calculus)

$$\pi_{A,B}(R(A, B, C)).$$

Exercise 2: B

Question: Specify in relational calculus (domain and tuple calculus)

$$\pi_{A,B}(R(A, B, C)).$$

Answer:

$$\{\mathrm{r}\,.\mathrm{A}, \mathrm{r}\,.\mathrm{B} \mid \mathrm{R}(\mathrm{r})\}$$

———

$$\{\mathrm{a}\ \ \mathrm{b} \mid \mathrm{R}(\mathrm{a}\ \ \mathrm{b}\ \ \mathrm{c})\}$$

Exercise 2: C

Question: Specify in relational calculus (domain and tuple calculus)

$$R(A, B, C) * S(C, D, E)$$

Exercise 2: C

Question: Specify in relational calculus (domain and tuple calculus)

$$R(A, B, C) * S(C, D, E)$$

Answer:

$$\{\mathrm{r.A}, \mathrm{r.B}, \mathrm{r.C}, \mathrm{s.D}, \mathrm{s.E} \mid \mathrm{R(r)} \text{ and } \mathrm{S(s)} \text{ and } \mathrm{r.C} = \mathrm{s.C}\}$$

$$\overline{\{\mathrm{a\ b\ c\ d\ e} \mid \mathrm{R(a\ b\ c)} \text{ and } \mathrm{S(c\ d\ e)}\}}$$

Exercise 2: D

Question: Specify in relational calculus (domain and tuple calculus)

$$R(A, B, C) \cup S(A, B, C)$$

Exercise 2: D

Question: Specify in relational calculus (domain and tuple calculus)

$$R(A, B, C) \cup S(A, B, C)$$

Answer:

$$\{x \mid R(x) \text{ or } S(x)\}$$

———

$$\{a\ b\ c \mid R(a\ b\ c) \text{ or } S(a\ b\ c)\}$$

Exercise 2: E

Question: Specify in relational calculus (domain and tuple calculus)

$$R(A, B, C) \cap S(A, B, C).$$

Exercise 2: E

Question: Specify in relational calculus (domain and tuple calculus)

$$R(A, B, C) \cap S(A, B, C).$$

Answer:

$$\{x \mid R(x) \text{ and } S(x)\}$$

———

$$\{a\ b\ c \mid R(a\ b\ c) \text{ and } S(a\ b\ c)\}$$

Exercise 2: F

Question: Specify in relational calculus (domain and tuple calculus)

$$R(A, B, C) - S(A, B, C).$$

Exercise 2: F

Question: Specify in relational calculus (domain and tuple calculus)

$$R(A, B, C) - S(A, B, C).$$

Answer:

```
{x | R(x) and not S(x)}
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{a b c | R(a b c) and not S(a b c)}
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Exercise 2: G

Question: Specify in relational calculus (domain and tuple calculus)

$$R(A, B, C) \times S(A, B, C)$$

Exercise 2: G

Question: Specify in relational calculus (domain and tuple calculus)

$$R(A, B, C) \times S(A, B, C)$$

Answer:

```
{r.A, r.B, r.C, s.A, s.B ,s.C | R(r) and S(s)}
———
{a b c d e f | R(a b c) and S(d e f)}
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Exercise 2: H

Question: Specify in relational calculus (domain and tuple calculus)

$$R(A, B) \div S(A).$$

Exercise 2: H

Question: Specify in relational calculus (domain and tuple calculus)

$$R(A, B) \div S(A).$$

Answer:

$\{$r.B | R(r) and $(\forall s)$ (not S(s) or
$(\exists q)$ (R(q) and q.A=s.A and q.B=r.B))$\}$
$\{$b | R(c b) and $(\forall a)$ (not S(a) or (R(a b)))$\}$