Bill Davis
605.441 Problem Set 3

1. (6.13) A safe expression is one in which there can only be a finite number of results. An expression can be guaranteed to be safe if all the results of the expression come from the expressions domain. This prevents expressions like a tuple is not in relation r. Since there are an infinite number of relations that are not r, this expression is unsafe.

2. (6.16)

   (a) (c)
   Relational Algebra $\pi_{lname,fname}(\sigma_{superssn=33344555}(\text{EMPLOYEE}))$
   .
   Tuple Relational $\{t^{(2)s} | \exists(e)(\text{EMPLOYEE}(e) \text{ ^ } e[\text{Super\_ssn}] = 33344555$
   ^ t[0]=e[Lname] ^ t[1] = e[Fname])}
   .
   Domain Relational { Lname, Fname | EMPLOYEE(Fname, Lname,
   Super_SSN) ^ Super_ssn = 3344555 }
   .
   The result of the query is (Smith, John), (Narayan, Ramesh), (English, Joyce)

   (b) (e)
   Relational Algebra $\pi_{lname,fname}$((EMPLOYEE $\bowtie_{ssn=essn}$ PROJECT)
   $\div$ π_{Pno}(PROJECT))
   .
   Tuple Relational { $t^{(2)}$| ∀(p)(PROJECTS(w) ^ ∃(w)∃(e)(WORKS_ON)(w)
   ^ EMPLOYEE(e) ^ w[Pno] = p[Pnumber] ^ w[Essn] = e[ssn] ^
   t[1] = e[Lname] ^ t[2] = e[Fname]}
   .
   Domain Relational
   { Lname, Fname — ∀(p, e) (PROJECT(p) ^ EMPLOYEE(e) ^
   (∃(w)(WORKS_ON(w) ^ w = p) }
   .
   The result of this query is ∅

   (c) (f) Domain Relational
   $\pi_{lname,fname}$(WORKS_ON $\bowtie_{ssn=essn}$ EMPLOYEE) - $\pi_{lname,fname}$(EMPLOYEE)
   Tuple Relational
   { $t^{(2)}$| ∀(E)(EMPLOYEE(E) ^ ∀(w)(WORKS_ON)(w) ^ NOT(p[ssn]
   = w[essn]) ^ t[1] = e[Lname] ^ t[2] = e[Fname]} .
   The result of this query is ∅

3. (6.22)

(a) (a)

P	Q	R	A	B	C
10	a	5	10	b	6
10	a	5	10	b	5
25	a	6	25	c	3

(b) (d)

P	Q	R	A	B	C
15	b	8	10	b	6
15	b	8	10	b	5