CS 1555 HW 4

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1. (a) Arity = 1, Min = 1, Max = 1

   $J \leftarrow \sigma_{start\_timestamp \geq '2019-08-01\ 00:00:00' \wedge start\_timestamp < '2019-09-01\ 00:00:00'}(RECORDS)$

   $PA \leftarrow J \bowtie_{from\_pn=cell\_pn} (\sigma_{state='PA'} DIRECTORY)$

   $RSLT \leftarrow F_{max(Duration)} PA$

   (b) Arity = 2 (zip, avg(payment_count)), Min = 0 (if there are no statements in Nov 2019), Max = 50 (50 different zip codes)

   $S \leftarrow \sigma_{start\_date \geq '2019-11-01\ 00:00:00' \wedge end\_date < '2019-12-01\ 00:00:00'}(Statements)$

   $R \leftarrow \Pi_{cell\_pn} S$

   $COUNT(zip, payment\_count) \leftarrow_{zip} F_{count(cell\_pn)} R$

   $RSLT \leftarrow_{zip} F_{avg(payment\_count)}$

   (c) Arity = 2, Min = 0, Max = 25 (every customer could have 2 cell_pns, so that would mean 50/2, or 25 maximum cell_pns)

   $S(SSN, cell\_pn\_count) \leftarrow_{SSN} F_{count(cell\_pn)}$

   $R \leftarrow \sigma_{cell\_pn\_count > 1} S$

   $RSLT \leftarrow \Pi_{fname,lname}(R * Customers)$

   (d) Assumption: If the there is only one Customer with a last name, we consider no one else in their family to be a customer of P_Mobile

   Assumption: The count function does not count duplicates. For example, if there are two SSNs that are the same, $COUNT(SSN)$ would return 1.

   Arity = 1, Min = 0, Max = 50

   $C(lname, count\_ssn) \leftarrow_{lname} F_{count(SSN)} Customers$

   $RSLT \leftarrow \Pi_{lname} (\sigma_{count\_ssn=1} C)$

   (e) Arity = 1, Min = 0, Max = 1

   This question is vague, so I will assume that it is asking to find the sum of the minutes and sms for this customer in this time period, and then I assume you can use arithmetic in relational algebra.

   $C \leftarrow \sigma_{cell\_pn=4129876543\ \wedge\ start\_date\ \geq\ '1-01-2019'}(Statements)$

   $T \leftarrow F_{sum(total\_minutes),sum(total\_SMS)} C$

   $RSLT = \Pi_{charges=(0.25*total\_minutes+0.05*total\_SMS)/100} T$

2. See next page

Table 1: R

A	**B**	**C**	**D**
0	0	0	1
0	0	0	2
0	0	0	3
0	0	0	4
0	0	0	5
0	0	0	8
0	0	0	9
0	0	0	10
0	0	0	11
0	0	0	12
0	0	0	13
0	0	0	14
0	0	0	15

Table 2: S

D	**E**	**F**
1	0	0
2	0	0
3	0	0
4	0	0
5	0	0
6	0	0
7	0	0

Table 3: R full-outer-join(R.D = S.D) S

R.A	**R.B**	**R.C**	**R.D**	**S.D**	**S.E**	**S.F**
0	0	0	1	1	0	0
0	0	0	2	2	0	0
0	0	0	3	3	0	0
0	0	0	4	4	0	0
0	0	0	5	5	0	0
0	0	0	8	null	null	null
0	0	0	9	null	null	null
0	0	0	10	null	null	null
0	0	0	11	null	null	null
0	0	0	12	null	null	null
0	0	0	13	null	null	null
0	0	0	14	null	null	null
0	0	0	15	null	null	null
null	null	null	null	6	0	0
null	null	null	null	7	0	0