HW 8

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Artificial Intelligence

Q1

KB: $P \to (q \to r)$

Q: $(p \to q) \to (p \to r)$

Starting

$(p \to (q \to r))$ implication elimination

$(\neg p \vee (\neg q \vee r))$ implication elimination

$(\neg p \vee \neg q \vee r)$ Conjunctive normal form

having one

so sentences

a1: $(\neg p \vee \neg q \vee r)$

b: $p \vee q \vee r$

now and em are elimination

$(\neg p \vee \neg q \vee r) \wedge (p \vee q \vee r)$

empty. this by ~~resolution~~ resolution

$p \to (q \to r) \equiv$

$(p \to q) \to (p \to r)$.

so Q in CNF

$(p \to q) \to (p \to R)$

$(\neg p \vee q) \to (\neg p \vee R)$

$\neg(\neg p \vee q) \vee (\neg p \vee R)$ implication elimination

$\neg(\neg p) \wedge \neg q \vee \neg p \vee R =$

$p \wedge \neg q \vee \neg p \vee R$

$(p \wedge \neg q) \vee \neg p \vee R$

CNF =

$\neg p \vee \neg q \vee r$

b = $\neg$(CNF) :

$p \vee q \vee \neg r$

Spring

should a US city and
age between two
gardless of

Now repeat

Q2

1. Riddle 1 : Everything except for buildings jump higher than a building.

Riddle 2 : At least half of the politicians in whica some are honest are liars.

The second riddle might be ambiguous because it might imply that only One politician is honest.

So

Out of a party of 100 politicians, only one is honest

There exists one exactly 100 politicians, and exactly one of them is a liar

2. Riddle 1 — a just represents after all finding's domains — 3 variables

b is a Buildings

Riddle 2 — x (variable) represents all politicians — z represents an object

3 Riddle 1

3. Riddle 1

The predicates are jumps higher

is Building

jumps higher

is Building(a) — is it a a is a Building

jumps higher(a,b) — a jumps higher than b

count 100 Riddle 2

count100(x) — The predicates are

number of x is 100 is Liar

isLiar(x)

4. $\forall a \forall b$ (isBuilding(a) $\rightarrow$ jumpsHigher(a,b)) if politician is a Liar

Riddle 1

Riddle 2 $\forall x$ count100(x) $\wedge$ ($\exists x$ isLiar(x) $\wedge \exists z$ (Liar(z) $\rightarrow x=z$))

for all politicians — there are 100 politicians

Now repeat ...

Q3

1. Unit: miles

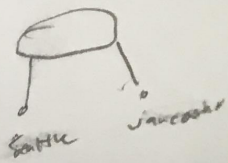
	Madison	Seattle	Boston	Vancouver	Winnipeg	Montreal
Madison	0	1960	1129	2097	724	987
Seattle	1960	0	3080	1441	1392	2940
Boston	1129	3080	0	3217	1844	319
Vancouver	2097	144	3217	0	1453	3076
Winnipeg	724	1392	1844	1453	0	1705
Montreal	987	2940	319	3076	1705	0

CP: Vancouver - Seattle

2. Closest pair is Seattle Vancouver so merge

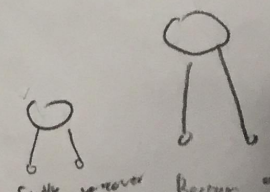
	Ma	S/V	B	W	Mo
Ma	0	1960	1129	724	987
S/V	1960	0	3080	1392	2940
B	1129	3080	0	1844	319
W	724	1392	1844	0	1705
Mo	987	2940	319	1705	0

Closest pair is boston montreal



	Ma	S/V	B/Mo	W
Ma	0	1960	987	724
S/V	1960	0	2940	1392
B/Mo	987	2940	0	1705
W	724	1392	1705	0

Closest pair is madison winnipeg

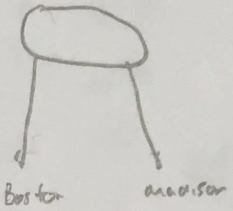


Now repeat ...

3). US city and canadian city not in the cluster

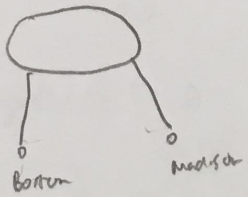
1. closest pair two would be Boston and madison

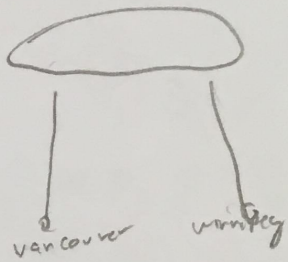
	B/ma	S	V	W	Mo
B/ma	0	1960	2097	724	319
S	1960	0	144	1392	2940
V	2097	144	0	1453	3076
W	724	1392	1453	0	1705
Mo	319	2940	3076	1705	0



now closest city are
Vancouver and winnipeg

	B/ma	S	V/W	Mo
B/ma	0	1960	724	319
S	1960	0	144	2940
V/W	724	144	0	1705
Mo	319	2940	1705	0





Spring 2018

Q4 k-means Clustering

$X_1 = 6 \quad X_2 = 2 \quad X_3 = 4 \quad X_4 = 6 \quad X_5 = 7 \quad X_6 = 6$

$k = 2$

1. $C_1 = 1 \quad C_2 = 10$

	dC_1	dC_2	Cluster
X_1	1	10	C_1
X_2	1	8	C_1
X_3	3	6	C_1
X_4	5	4	C_2
X_5	6	3	C_2
X_6	5	4	C_2

C_1 C_2

0 2 4 6 7 6

average $C_1 = 0+2+4 = 6$ $C_2 = 6+7+6 = 19$

$\frac{0+2+4}{3} = 2$ $\frac{6+7+6}{3} = 6.\overline{33}$

$C_1 = 2$ $C_2 = 6.\overline{33}$

	dC_1	dC_2	cluster
X_1	2	4.33	C_1
X_2	0	4.33	C_1
X_3	2	2.33	C_1
X_4	4	0.33	C_2
X_5	5	1.33	C_2
X_6	4	0.33	C_2

$C_1 = 0+2+4 = 6$

$C_2 = 6+7+6 = 19$

Now repeat $C_1 = 1$ $C_2 = 2$

	dC_1	dC_2	Cluster
X_1	1	2	C_1
X_2	1	0	C_2
X_3	3	2	C_2
X_4	5	4	C_2
X_5	6	5	C_2
X_6	5	4	C_2

every C_1 0

C_2 25

avg = 0 for C_1

avg C_2 = $\frac{2+4+6+7+6}{5} = 5$

$C_1 = 0$ $C_2 = 5$

	dC_1	dC_2	cluster
X_1	0	5	C_1
X_2	2	3	C_1
X_3	4	1	C_2
X_4	6	1	C_2
X_5	7	2	C_2
X_6	6	1	C_2

every $C_1 = 2$

every C_2 = 23

avg $C_1 = \frac{0}{2} = 1$ avg $C_2 = \frac{23}{4} = 5.75$

3. $C_1 = 1$ and $C_2 = 10$ is better because it allows for the greatest variance and for the clusters to be grouped the most easily.