DataBaseHW1

Kun Liu

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Part1

1.1

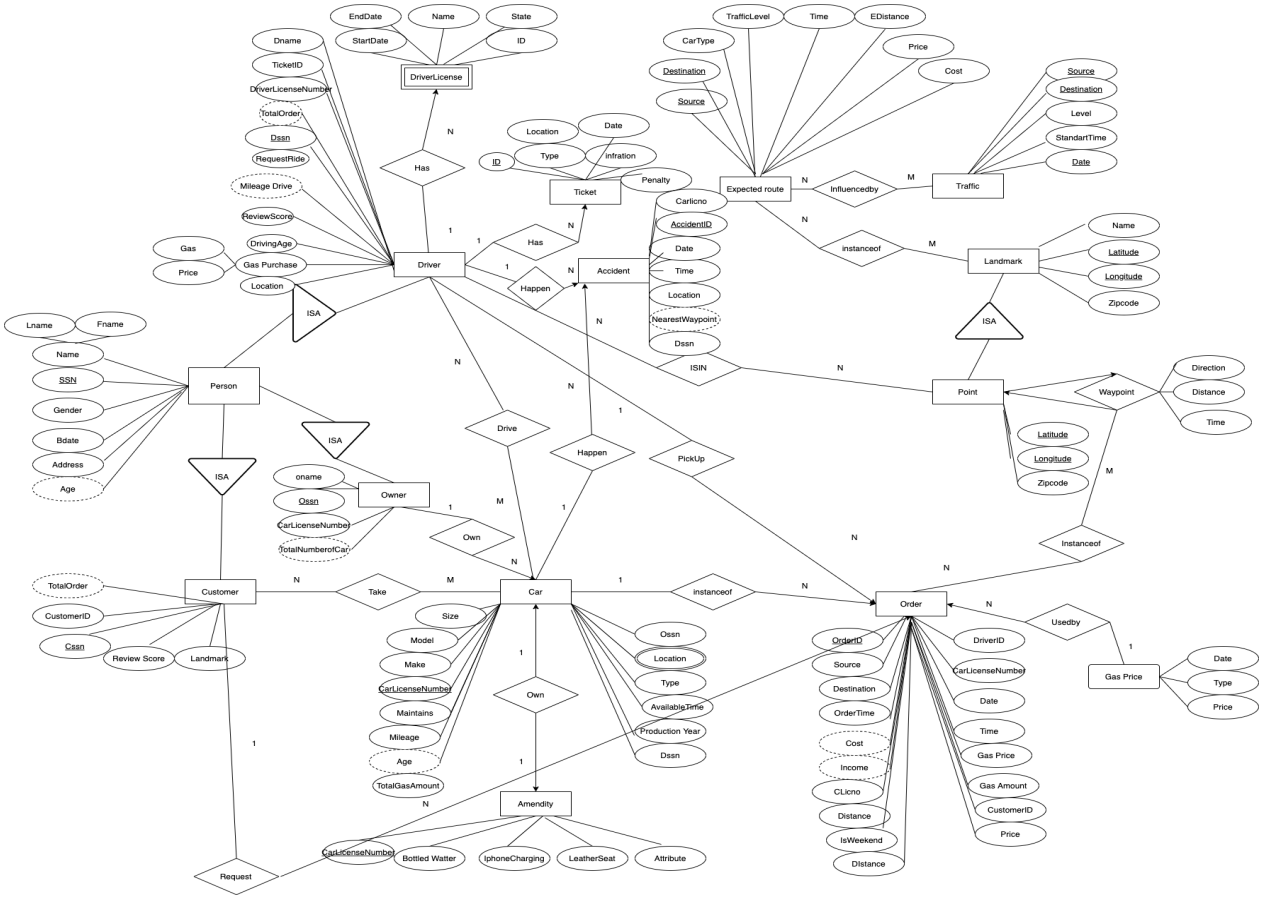

Figure 1: ERModel

Assumption:
1. Driver will fill up gas every morning, and will run out gas every evening, the gas price doesn't change in one day.
2. the cost for a driver is only something about filling up gas.
3. Driver can pick up customer at any points.
4.The traffic level is the same on a day in several weeks(Previous Wednesday = Next Wednesday)

Unusual Controversial design decisions:
I don't record when a driver starts to work and when he stops to work everyday, I just record the time and distance they are in a order.So the avg(distance/time) is not exact.For any Point, it will have 4 directions to other points, which will cause the content of this table is too much.

1.2

Unusual Controversial design decisions:
Using latitude and longitude to identify a point, which is indirect.And we only can see the difference for trips which start from a landmark and end to a landmark.(Cause we only store the information from landmark to landmark in Expected route table.

PERSON	LNAME	FNAME	SSN	GENDER	BDATE	ADDRESS	Name
	KUN	LIU	123456789	MALE	7/9/96	100 WEST	KUN LIU

Figure 2: Person

DRIVER	DSSN	DLICNO	TICKETID	REQUESTRIDE	REVIEWSCORI	DRIVINGAGE	LOCATION	Dname	ID
	123456789	5656789	1	20	90	10	41°24'12.2"N 2°10'26.5"E	Kun Liu	2008

Figure 3: Driver

CUSTOMER	CSSN	REVIEWSCOI	LANDMARK	CUSTOMERID
	111111111	95	Homewood	1111111

Figure 4: Customer

OWNER	OSSN	CLICNO	ONAME
	123456789	443443MD	Kun Liu

Figure 5: Owner

DRIVERLICENSE	NAME	ID	STATE	STARTDATE	ENDDATE
	KUN LIU	5656789	MD	8/9/10	8/9/21

Figure 6: DriverLicense

CAR	CLICNO	OSSN	SIZE	MODEL	MAKE	MAINTAINSTime	MILEAGE	LOCATION	TYPE	AVAILABETIME	PRODUCTION YEAR	DSSN	TOTALGASAMOUNT
	443443MD	123456789	large	Camry	Toyota	8/9/20	100000km	41°24'12.2"N 2°10'26.5"E	Electronic car	10:20Am	2017	123456789	1000L

Figure 7: Car

AMENDITY	BOTTLEDWA	IPHONECHAR	LEATHERSEA	ATTRIBUTE	CLICNO
	1	1	0	1	443443MD

Figure 8: Amenity

TICKET	ID	TYPE	INFRATION	PENALTY	Location	Date
	1	Red Light	1	500$	41°24'12.2"N	8/9/20

Figure 9: Ticket

ACCIDENT	DSSN	LOCATION	TIME	DATE	ACCIDENTID	CARLICNO	NearestWayPoint
	123456789	41°24'12.2"N 2°10'26.5"E	10:20am	9/8/19	123456	443443MD	41°24'12.2"N 2°10'26.5"E

Figure 10: Accident

EXPTECTED ROUTE	SOURCE	DESTINATION	CARTYPE	TRAFFICLEVEL	TIME	EDISTANCE	PRICE	COST
	JHU Hospital	JHU Homewood	Electronic car	Low	20mins	2miles	20$	15$

Figure 11: Expected Route

TRAFFIC	SOURCE	DESTINATION	LEVEL	STANDARTTIM	DATE
	JHU Hospital	JHU Homewood	Low	20mins	Wednesday

Figure 12: Traffic

LANDMARK	NAME	LATITUDE	LONGITUDE	ZIPCODE
	JHU Homewood	39.3299° N	76.6205° W	21218

Figure 13: Landmark

POINT	LATITUDE	LONGITUDE	ZIPCODE
	38.2222N	77.6241W	21210

Figure 14: Point

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WAYPOINT	DIRECTION	DISTANCE	TIME	SOURCE	DESTINATION
	south	2miles	20mins	JHU Hospital	JHU Homewood

Figure 15: WayPoint

ORDER	ORDERID	DRIVEID	SOURCE	DESTINATION	ORDERTIME	CLICNO	DATE	TIME	GASPRICE	GASAMOUNT	CUSTOMERID	ISWEEKEND	PRICE	Distance
	1	2008	JHU Hospital	JHU Homewoo	10:20:00 AM	443443MD	9/8/20	21mins	10$/L	1.5	111111111	0	25$	2miles

Figure 16: Order

GAS	DATE	TYPE	PRICE
	9/8/20	No.95	10$/L

Figure 17: Gas

c:
BothDC$\leftarrow (Driver \bowtie_{dssn=cssn} Customer)$
$DriveEC \leftarrow \Pi_{dssn}(\sigma_{type="ElectronicCar"}(Driver \bowtie_{clicno=clicno} Car))$
$BothDCEC \leftarrow (BothDC \bowtie DriverEC)$
$BothDCNotEC \leftarrow (BothDC - BothDCEC)$
$Result \leftarrow \Pi_{name}(Person \bowtie_{ssn=dssn} BothDCNotEC)$

f:
CarInAO$\leftarrow (Accident \bowtie_{clicno=clicno} Car \bowtie_{clicno=clicno} Owner)$
$CarInAD \leftarrow (Accident \bowtie_{clicno=clicno} Car \bowtie_{clicno=clicno} Driver)$
$CarInAOwnerName \leftarrow (CarInAO \bowtie_{ossn=ssn} Person)$
$CarInADriverName \leftarrow (CaInAD \bowtie_{dssn=ssn} Person)$
$Result \leftarrow \Pi_{date,time,nearestwayPoint,oname,dname}(CarInAOwnerName)$

h:
CarDO$\leftarrow \sigma_{dssn=ossn}(Car)$
$CarDnotO \leftarrow (Car - CarDO)$
$Result \leftarrow \Pi_{make,model,year,mileage,dname,oname}(Driver \bowtie_{clicno=clicno} Car \bowtie_{clicno=clicno} Owner)$

y:
OrderAmoreE$\leftarrow \sigma_{date="9/12/20" \wedge distance>edistance}(Order \bowtie_{source=source \wedge destination=destionation} ExpecteRoute)$
$Result \leftarrow \Pi_{source,destination,dname}(OrderAmoreE \bowtie_{driveid=id} Driver)$

ss:
DriveVisitedSLM$\leftarrow \Pi_{driverid,source(lm)}(Order)$
$DriverVisitedDLM \leftarrow \Pi_{driverid,destination(lm)}(Order)$
$DriverDSLM \leftarrow (DriverVisitedSLM \cup DriverVisitedDLM)$
$LMName \leftarrow \sigma_{name}(LandMark)$

$Result \leftarrow (Driver \bowtie_{id=driverid} (DriverDSLM \div LMName))$

ccc:
Result$\leftarrow \Pi_{make,model,productionyear}(\sigma_{Max(mileage \div totalgasamount)}(Car))$

Part2

Part2 Relation Algebra

2.1

ITrump $\leftarrow \sigma_{\text{DName="Ivanka Trump"}}(Drinker)$
$ITBarDate \leftarrow \Pi_{bno,dataofvisit}(ITrump \bowtie_{dlicno=dlicno} Visit)$
$PDLicNo \leftarrow \Pi_{dlicno}(ITBarDate \bowtie Visit)$
$Result \leftarrow \Pi_{dname,politicalparty}(PDLicNo \bowtie_{dlicno=dlicno} Drinker)$

2.2

BarInMD$\leftarrow \sigma_{Bstate="MD"}(Bar)$
$BarInBal \leftarrow \sigma_{Bcity="Baltimore"}(Bar)$
$BarInMDnotBal \leftarrow BarInMD - BarInBal$
$BarInMDnotBalServeBudLite \leftarrow (Bar \bowtie_{bno=bno} (\sigma_{beername="BudLite"}(Serves))$
$BarInMDnotBalNotServeBudLite \leftarrow BarInMDnotBal - BarInMDnotBalServeBudLite$
$Result \leftarrow \Pi_{barname}(BarInMDnotBalNotServerBudLite \bowtie Bar)$

2.3

BarInGeorgetown$\leftarrow \sigma_{Bcity="Gergetown"}(Bar)$
$PUnder30VGT \leftarrow \Pi_{dlicno}(BarInGeorgetown \bowtie_{bno=bno} Visit \bowtie_{dlicno=dlicno} (\sigma_{age<30}Drinker))$
$PLikeBL \leftarrow \sigma_{beername="BudLite"}(Likes)$
$PLikeML \leftarrow \sigma_{beername="MillerLite"}(Likes)$
$PDontLikeML = Likes - PLikeML$
$PLikeBLDontLikeML = PLikeBL \cap PDontLikeML$
$Result \leftarrow \Pi_{dname}(PUnder30VGT \bowtie PLikeBLDontLikeML)$

2.4

DTrump$\leftarrow \sigma_{dname="DonaldTrump"}(Drinker)$
$DTBar \leftarrow \Pi_{bno}(DTrump \bowtie_{dlicno=dlicno} Visit)$
$Result \leftarrow \Pi_{dname,age}(Drinker \bowtie_{dlicno=dlicno} Visit \bowtie_{bno=bno} DTBar)$

2.5

AllBarinTowson$\leftarrow \sigma_{bcity="Towson"}(Bar)$
$PVisitBarinTowson \leftarrow (AllBarInTowson \bowtie_{bno=bno} Visit \bowtie_{dlicno=dlicno} Drinker)$
$Result \leftarrow \Pi_{name,age}(PVisitBarInTowson \div AliiBarinTowson)$

2.6

PVisitBar$\leftarrow \Pi_{dlicno}(Visit)$
$PSufferCOVID \leftarrow \Pi_{dlicno}Covid\_diagnosis$
$PVisitBarOrSufferCOVID \leftarrow (PVisitBar \cup PsufferCOVID)$
$Result \leftarrow \Pi_{name,birthday}(Drinker - PVisitBarOrSufferCOVID)$

2.7

DTrump$\leftarrow \sigma_{dname="DonaldTrump"}(Drinker)$
$DTBar \leftarrow \Pi_{bno}(DTrump \bowtie_{dlicno=dlicno} Visit)$
$PVDTBar \leftarrow (DTBar \bowtie Visit)$
$PVEveryDTBar \leftarrow (PVDTBar \div DTBar)$
$JBiden \leftarrow \Pi_{dlicno}(\sigma_{dname="JoeBiden"}(Drinker))$
$JBBar \leftarrow \Pi_{bname}(JBide \bowtie_{dlicno=dlicno} Visit)$
$PVisitJBBar \leftarrow (Visit \bowtie JBBar)PDontVisitJBBar \leftarrow (Visit - PVisitJBBar)$
$Result \leftarrow \Pi_{name,age}(PVEveryDTBar \bowtie_{dlicno=dlicno} PDontVisitJBBar \bowtie Drinker)$

2.8

PVisitBar$\leftarrow \Pi_{dlicno}(Visit)$
$PDrunkSA \leftarrow \Pi_{dlicno}(\sigma_{beername="SamAdams"}Beer\_purchase)$
$Result \leftarrow \Pi_{name}(Drinker \bowtie_{dlicno=dlicno} (PVisitBar - PDrunkSA))$

2.9

DTrump$\leftarrow \sigma_{dname="DonaldTrump"}(Drinker)$
$DTLikesBeer \leftarrow \Pi_{beername}(DTrump \bowtie_{dlicno=dlicno} Likes)$
$BarServeDTLikes \leftarrow (DTLikesBeer \bowtie_{beername=beername} Serves \bowtie Bar)$
$Result \leftarrow \Pi_{bname}((Bar \bowtie Serves) - BarServeDTLikes)$

2.10

BarinTimonium$\leftarrow \sigma_{bcity="Timonium"}(Bar)$
$BeerServeinTimonium \leftarrow \Pi_{beername}(BarinTimonium \bowtie_{bno=bno} Serves)$
$BarInTowson \leftarrow \sigma_{bcity="Towson"}(Bar)$
$BarInTowsonServeBeer \leftarrow (BarinTowson \bowtie_{bno=bon} Serves)$
$BarInTowsonServeTheseBeer \leftarrow (BarinTowsonServeBeer \bowtie_{beername=beername} BeerServeinTimonium)$
$Result \leftarrow \Pi_{bname}((Bar \bowtie Serves) - BarInTowsonServeThesesBeer)$

2.11

DTrump$\leftarrow \sigma_{dname="DonaldTrump"}(Drinker)$
$DTLikesBeer \leftarrow \Pi_{beername}(DTrump \bowtie_{dlicno=dlicno} Likes)$
$ITrump \leftarrow \sigma_{dname="IvankaTrump"}(Drinker)$
$ITLikesBeer \leftarrow \Pi_{beername}(ITrump \bowtie_{dlicno=dlicno} Likes)$
$BarServeDTLikeBeer \leftarrow \Pi_{bno}(DTLikesBeer \bowtie_{beername=beername} Serves)$
$BarServeITLikeBeer \leftarrow \Pi_{bno}(ITLikesBeer \bowtie_{beername=beername} Serves)$
$BarBothDTAndITLike \leftarrow \Pi_{bno}(BarServeDTLikeBeer \cap BarServeITLikeBeer)$
$Result \leftarrow \Pi_{name}(BarBothDTANDITLike \bowtie_{bno=bno} Bar)$

2.12

Num_serves$\leftarrow \sigma_{Num_serves(bno,Numbeer)} Bno\mathcal{G}COUNT(beername)Serves$
$Max\_num\_serves \leftarrow \sigma_{Max\_num\_serves(MaxNum)}\mathcal{G}MAX(Numbeer)Num\_serves$
$Max\_bno \leftarrow \Pi_{bno}(Num\_serves \bowtie_{Numbeer=MaxNum} Max\_num\_serves)$
$Result \leftarrow \Pi_{barname,bcity,bstate}(Bar \bowtie_{bno=bno} Max\_bno)$

2.13

Num_likes$\leftarrow \sigma_{Num_likes(dlicno,Numbeer)} dlicno\mathcal{G}COUNT(beername)Likes$
$Min\_num\_dlicno \leftarrow \sigma_{Min\_num\_dlicno(MinNum)}\mathcal{G}MIN(Numbeer)Num\_Likes$
$Min\_dlicno \leftarrow \Pi_{dlicno}(Num\_likes \bowtie_{Numbeer=MinNum} Min\_num\_dlicno)$
$Result \leftarrow \Pi_{dname,age}(Drinker \bowtie_{dlicno=dlicno} Min\_dlicno)$

2.14

DTrump$\leftarrow \sigma_{dname="DonaldTrump"}(Drinker)$
$MPence \leftarrow \sigma_{dname="MikePence"}(Drinker)$
$DTLikesBeer \leftarrow \Pi_{beername}(DTrump \bowtie_{dlicno=dlicno} Likes)$
$MPLikesBeer \leftarrow \Pi_{beername}(MPence \bowtie_{dlicno=dlicno} Likes)$
$DTLikeOrMKLike \leftarrow (DTLikesBeer \cup MPLIkesBeer)$
$DrinkerLikeDTORMK \leftarrow (Likes \bowtie_{beername=beername} DTLikeOrMKLike)$
$Result \leftarrow \Pi_{name,politicalParty}((Drinker \bowtie Likes) - (DrinkerLikeDTORMK \bowtie Drinker))$

2.15

DTrump$\leftarrow \sigma_{dname="DonaldTrump"}(Drinker)$
$AllDTLikesBeer \leftarrow \Pi_{beername}(DTrump \bowtie_{dlicno=dlicno} Likes)$
$DrinkerLikeAllDTBeer \leftarrow (Likes \div ALLDTLikesBeer) Result \leftarrow \Pi_{name,politicalparty}(DrinkerLikesAllDT$
$Drinker)$

2.16

Result$\leftarrow \Pi_{beername}(\sigma_{dateofpurchase<estimatedEnddata \wedge dataofpurchase>estimatedstartDate}(Beer_purchase \bowtie$
$Covid\_diagnosis))$

2.17

DTrump$\leftarrow \sigma_{dname="DonaldTrump"}(Drinker)$
$DTVisitBar \leftarrow (DTrump \bowtie Visit)$
$DTVisitBarMoreThan1 \leftarrow \sigma_{COUNT(BNO)>1}(DTVisitBar)$
$Result \leftarrow \Pi_{barname}(DTVisitBarMoreThan1 \bowtie_{bno=bno} Bar)$

2.18

ITrump$\leftarrow \sigma_{dname="IvankaTrump"}(Drinker)$
$ITVisit \leftarrow (ITrump \bowtie Visit)$
$ITVCovid \leftarrow (\sigma_{dateofVisit<estimatedEnddata \wedge dataofvisit>estimatedstartDate}(ITVisit \bowtie Covid\_diagnosis))$
$DrinkerVisitSameITVCovid \leftarrow (ITVCovid \bowtie_{bno=bno \wedge dateofVisit=dateofVisit} Visit)$
$Result \leftarrow \Pi_{name,phonenumber}(DrinkerVisitSameITVCovid \bowtie Drinker)$

2.19

VisitDuringAllBD$\leftarrow (Visit \bowtie AllBnoDateofVisit)$
$Result \leftarrow \Pi_{name,phonenumber}(VisitDuringAllBD \bowtie Drinker)$

2.20

ALLVisitCovid$\leftarrow (\sigma_{dateofVisit<estimatedEnddata \wedge dataofvisit>estimatedstartDate}(Visit \bowtie Covid_diagnosis))$
$Result \leftarrow \Pi_{dname,barname,estimatedStartDate,estimatedEndDate}(AllVisitCovid \bowtie_{dlicno=dlicno} Drinker \bowtie_{bno=bno} Bar)$

2.21

JBiden$\leftarrow \sigma_{dname="JoeBiden"}(Drinker)$
$JBBar \leftarrow \Pi_{bno}(JBide \bowtie_{dlicno=dlicno} Visit)$
$NumBar\_JB_visit \leftarrow \sigma_{NumBar\_JB\_visit(bno,Numvisit)} bno\mathcal{G}COUNT(bno)JBBar$
$Num\_drinker_visit \leftarrow \sigma_{Num\_drinker_visit(dlicno,bno,Numvisit)} dlicno\mathcal{G}COUNT(bno)Visit$
$DSameBarJB \leftarrow \Pi_{dlicno}(Num\_drinker\_vist \div NumBar\_JB\_visit)$
$Result \leftarrow \Pi_{dname,age}(Drinker \bowtie_{dlicno=dlicno} DSameBarJB)$

2.22

AllDrinkerVaccinated$\leftarrow Drinker \bowtie Covid_Vaccine$
$AllDVDiagnosis \leftarrow AllDrinkerVaccinated \bowtie Covid\_Diagnosis$
$ALLDrinkerVSameDate \leftarrow \sigma_{dateofvaccine=dateofdiagnosis}(AllDrinkerVaccinated)$
$ALLDrinkerVaccinatedDifferentDate \leftarrow (AllDrinkerVaccinated - AllDrinkerVSameDate)$
$Result \leftarrow \Pi_{name,age,politicalparty}(Drinker \bowtie_{dlicno=dlicno} AllDrinkerVaccinatedDifferentDate)$

2.23

BeerServedinBatBar$\leftarrow \Pi_{beername}(\sigma_{barname=" Batbar"}(Bar \bowtie Serves))$
$DrinkerPurchasedBeerSBatBar \leftarrow (BeerServedinBatBar \bowtie_{beername=beername} Beer\_purchased)$
$DrinkerPurchasedAllBeerinBatbar \leftarrow (DrinkerPurchasedBeerSBatBar \div BeerServedinBatBar)$
$Result \leftarrow \Pi_{name,age}(DrinkerPurchasedAllBeerinBatebar \bowtie_{dlicno=dlicno} Drinker)$

Relation Calculus

2.1

$\{t \mid \exists \quad d, i \in Drinker($
$\exists \quad v \in Visit($
$i[dname] = "IvankaTrump"$
$\wedge\, i[dlicno] = v[dlicno]$
$landd[dateofvisit] = v[dateofvisit]$
$\wedge\, d[dlicno] == v[dlicno]$
$\wedge \wedge t[dname] = d[dname]$
$\wedge\, t[politicalparty] = d[politicalparty]))\}$

2.2

$\{t \mid \exists \quad b \in Bar($
$\exists \quad s \in Serves($
$b[bstate] = "MD"$
$\wedge \neg b[bcity] = "Baltimore"$
$\wedge \neg s[beername] = "BudLite"$
$\wedge\, b[bno] = s[bno]$
$\wedge\, t[barname] = b[barname]))\}$

2.3

$\{t \mid \exists \quad b \in Bar($
$\exists \quad d \in Drinker($
$\exists \quad v \in Visit($
$\exists \quad l \in Like($
$b[bcity] = "Georgetown"$
$\wedge\, d[age] < 30$
$\wedge \neg l[beername] = "BudLite"$

$\wedge \neg l[beername] = "MillerLite"$
$\wedge b[bno] = v[bno]$
$d[dlicno] = v[dlicno]$
$d[dlicno] = l[dlicno]$
$\wedge t[dname] = d[dname])))))\}$

2.4

$\{t \mid \exists \quad d, dt \in Drinker($
$\exists \quad v, pv \in Visit($
$dt[dname] = "DonaldTrump"$
$\wedge dt[dlicno] = v[dlicno]$
$\wedge d[dlicno] = pv[dlicno]$
$\wedge pv[bno] = v[bno]$
$\wedge t[dname] = d[dname]$
$\wedge t[age] = d[age]))\}$

2.9

$\{t \mid \exists \quad b \in Bar($
$\exists \quad s \in Serves($
$\nexists \quad dt \in Drinker($
$\exists \quad dl \in Like$
$dt[dname] = "DonaldTrump"$
$\wedge dl[dlicno] = dt[dlicno]$
$\wedge b[bno] = s[bno]$
$\wedge s[beername] = dl[beername]$
$\wedge t[barname] = b[barname])))\}$

2.10

$\{t \mid \exists \quad tw, tm \in Bar($
$\exists \quad tws \in Servers(\quad \forall \quad tms \in Serves($
$tw[bcity] = "Towson"$
$\wedge tm[bcity] = "Timonium"$
$\wedge \neg tws[beername] = tms[beername]$
$\wedge tw[bno] = tws[bno]$
$\wedge tm[bno] = tms[bno]$
$t[barname] = tm[barname]))\}$