Homework 1

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Part 1

Problem 1a

Cars

VIN	make	model	year	color
0	"Toyota"	"Tacoma"	2008	"Red"
1	"Toyota"	"Tacoma"	1999	"Green"
2	"Tesla"	"Model 3"	2018	"White"
3	"Subaru"	"WRX"	2016	"Blue"
4	"Ford"	"F150"	2004	"Red"

Salespeople

SSN	name
0	"Arnold"
1	"Jessica"
2	"Steve"

Selling

SSN	VIN
0	0
0	1
1	0
1	4
2	2

Problem 1b

Each salesperson can only sell up to one car.

Problem 1c

Each car can only be dealt by at most one salesperson.

Part 2

Problem 2

Attribute sets	Superkey	Proper subsets	Key
{A1}	no	{}	no
{A2}	no	{}	no
{A3}	no	{}	no
{A1, A2}	yes	{A1}, {A2}, {}	yes
{A1, A3}	no	{A1}, {A3}, {}	no
{A2, A3}	no	{A2}, {A3}, {}	no
{A1, A2, A3}	yes	{A1, A2}, {A1, A3}, {A2, A3}, {A1}, {A2}, {A3}, {}	no

Part 3

Problem 3a

- PK{CardNum}
- UQ{Serial}

Problem 3b

- PK{ISBN}
- UQ{Title, Author}

Problem 3c

- PK{ISBN}
- UQ{Title}

Problem 3d

- PK{Phone}

Part 4

Problem 4

- `CheckedOut.CardNum` references `Patrons.CardNum`
- `CheckedOut.Serial` references `Inventory.Serial`
- `Phones.CardNum` references `Patrons.CardNum`
- `Titles.ISBN` references `Inventory.ISBN`

Part 5

Problem 5a

True. If $\{x\}$ is a superkey, all cells in column x are unique, so all rows containing column x are forced to be unique too.

Problem 5b

False. If $\{x\}$ is a key, any set containing x will have $\{x\}$ as a proper subset, but that's already a superkey.

Problem 5c

True. Being a superkey is one condition of being a key.

Problem 5d

True. This is included in case 5a, where if $\{x\}$ is a superkey, then $\{x$, anything$\}$ is a superkey.

Problem 5e

False. As shown in 5d, If $\{x\}$ is a superkey, then $\{x, y\}$ is a superkey regardless of what is in column y (where y may contain duplicate cells).

Problem 5f

False. For example, if $\{x, y, z\}$ was a key, none of its proper subsets could be a superkey.

Problem 5g

True. A valid relation must have unique rows, so in this case it is only possible that $\{x, y, z\}$ is a key, since no other combination of attributes make a key to enforce that uniqueness.

Problem 5h

False. The following relation has one unique $<x, z>$ pair (<0, 0>) but two unique y values, 0 and 1:

x	y	z
0	0	0
0	1	0