



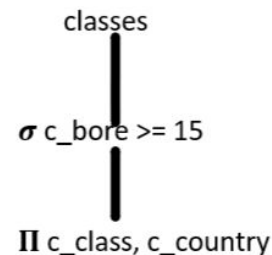
# CSE 111: Quiz 2

Oct 8, 2020

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- Find the class name and the country of the classes that carry guns of at least 15-inch bore.

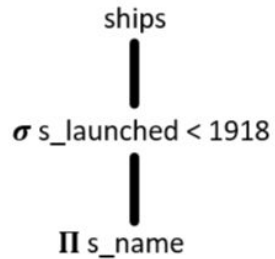
```
SELECT c_class, c_country
FROM classes
WHERE c_bore >= 15;
```



	classes						$\sigma_{c\_bore \geq 15}$						R = $\Pi_{c\_classes, c\_country}$	
Schema	(class, type, country, numGuns, bore, displacement)						(class, type, country, numGuns, bore, displacement)						(c_class, c_country)	
Tuples	c_class	c_type	c_country	c_numGuns	c_bore	c_displacement	c_class	c_type	c_country	c_numGuns	c_bore	c_displacement	C_class	C_country
	Bismarck	bb	Germany	8	15	42000	Bismarck	bb	Germany	8	15	42000	Bismarck	Germany
	Iowa	bb	USA	9	16	46000	Iowa	bb	USA	9	16	46000	Iowa	USA
	Kongo	bc	Japan	8	14	32000	<del>Kongo</del>	<del>bc</del>	<del>Japan</del>	<del>8</del>	<del>14</del>	<del>32000</del>		
	North Carolina	bb	USA	9	16	37000	North Carolina	bb	USA	9	16	37000	North Carolina	USA
	Renown	bc	Britain	6	15	32000	Renown	bc	Britain	6	15	32000	Renown	Britain
	Revenge	bb	Britain	8	15	29000	Revenge	bb	Britain	8	15	29000	Revenge	Britain
	Tennessee	bb	USA	12	14	32000	Tennessee	bb	USA	12	14	32000		
	Yamato	bb	Japan	9	18	65000	<del>Yamato</del>	<del>bb</del>	<del>Japan</del>	<del>9</del>	<del>18</del>	<del>65000</del>	Yamato	Japan

## 2. Find the ships launched prior to 1918.

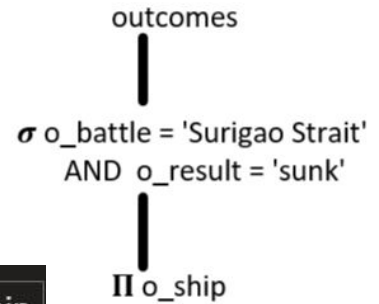
```
SELECT s_name
FROM ships
WHERE s_launched < 1918;
```



	ships			$\sigma$ s_launched < 1918			R = $\Pi$ s_name
Schema	(s_name, s_class, s_launched)			(s_name, s_class, s_launched)			(s_name)
Tuples	s_name	s_class	s_launched	s_name	s_class	s_launched	s_name
	California	Tennessee	1915	California	Tennessee	1915	California
	Haruna	Kongo	1915	Haruna	Kongo	1915	Haruna
	Hiei	Kongo	1915	Hiei	Kongo	1915	Hiei
	Iowa	Iowa	1933	<del>Iowa</del>	<del>Iowa</del>	<del>1933</del>	Kirishima
	Kirishima	Kongo	1915	Kirishima	Kongo	1915	Kongo
	Kongo	Kongo	1913	Kongo	Kongo	1913	Ramillies
	Missouri	Iowa	1935	<del>Missouri</del>	<del>Iowa</del>	<del>1935</del>	Renown
	Musashi	Yamato	1942	<del>Musashi</del>	<del>Yamato</del>	<del>1942</del>	Repulse
	New Jersey	Iowa	1936	<del>New Jersey</del>	<del>Iowa</del>	<del>1936</del>	Resolution
	North Carolina	North Carolina	1941	<del>North Carolina</del>	<del>North Carolina</del>	<del>1941</del>	Revenge
	Ramillies	Revenge	1917	Ramillies	Revenge	1917	Royal Oak
	Renown	Renown	1916	Renown	Renown	1916	Royal Sovereign
	Repulse	Renown	1916	Repulse	Renown	1916	Tennessee
	Resolution	Revenge	1916	Resolution	Revenge	1916	
	Revenge	Revenge	1916	Revenge	Revenge	1916	
	Royal Oak	Revenge	1916	Royal Oak	Revenge	1916	
	Royal Sovereign	Revenge	1916	Royal Sovereign	Revenge	1916	
	Tennessee	Tennessee	1915	Tennessee	Tennessee	1915	
	Washington	North Carolina	1941	<del>Washington</del>	<del>North Carolina</del>	<del>1941</del>	
	Wisconsin	Iowa	1940	<del>Wisconsin</del>	<del>Iowa</del>	<del>1940</del>	
	Yamato	Yamato	1941	<del>Yamato</del>	<del>Yamato</del>	<del>1941</del>	

### 3. Find the ships sunk in the battle of Surigao Strait.

```
SELECT o_ship
FROM outcomes
WHERE o_battle = 'Surigao Strait'
      AND o_result = 'sunk';
```

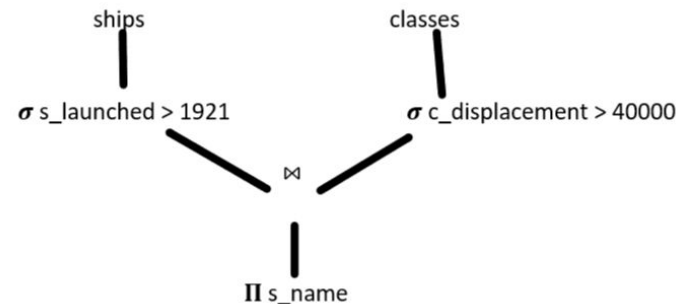


	Outcomes			$\sigma$ o_battle = 'Surigao Strait' AND o_result = 'sunk'			R = $\Pi$ o_ship
Schema	(o_ship, o_battle, o_result)			(o_ship, o_battle, o_result)			(o_ship)
Tuples	o_ship	o_battle	o_result	o_ship	o_battle	o_result	O_ship
	California	Surigao Strait	ok	<del>California</del>	Surigao Strait	ok	
	Kirishima	Guadalcanal	sunk	<del>Kirishima</del>	<del>Guadalcanal</del>	<del>sunk</del>	
	Resolution	Denmark Strait	ok	<del>Resolution</del>	<del>Denmark Strait</del>	<del>ok</del>	
	Wisconsin	Guadalcanal	damaged	<del>Wisconsin</del>	<del>Guadalcanal</del>	<del>damaged</del>	
	Tennessee	Surigao Strait	ok	<del>Tennessee</del>	Surigao Strait	<del>ok</del>	
	Washington	Guadalcanal	ok	<del>Washington</del>	Guadalcanal	<del>ok</del>	
	New Jersey	Surigao Strait	ok	<del>New Jersey</del>	Surigao Strait	<del>ok</del>	
	Yamato	Surigao Strait	sunk	Yamato	Surigao Strait	sunk	
	Wisconsin	Surigao Strait	damaged	<del>Wisconsin</del>	<del>Surigao Strait</del>	<del>damaged</del>	

## 4. List the ships with a displacement larger than 40000 tons built after 1921.

```
SELECT s_name
FROM ships, classes
WHERE c_class = s_class
      AND c_displacement > 40000
      AND s_launched > 1921;
```

Schema	Ships			$\sigma$ s_launched > 1921			classes						$\sigma$ c_displacement > 40000						R = $\Pi$ s_name	
	(s_name, s_class, s_launched)			(s_name, s_class, s_launched)			(c_class, c_type, c_country, c_numGun, c_bore, c_displacement)						(c_class, c_type, c_country, c_numGun, c_bore, c_displacement)						(s_name)	
	s_name	s_class	s_launched	s_name	s_class	s_launched	c_class	c_type	c_country	c_numGun	c_bore	c_displacement	c_class	c_type	c_country	c_numGun	c_bore	c_displacement	s_name	
Tuples	California	Tennessee	1915	California	Tennessee	1915	Bismarck	bb	Germany	8	15	42000	Bismarck	bb	Germany	8	15	42000	lowa	
	Haruna	Kongo	1915	Haruna	Kongo	1915	lowa	bb	USA	9	16	46000	lowa	bb	USA	9	16	46000	Missouri	
	Hiei	Kongo	1915	Hiei	Kongo	1915	Kongo	bc	Japan	8	14	32000	Kongo	bc	Japan	8	14	32000	Musashi	
	lowa	lowa	1933	lowa	lowa	1933	North Carolina	bb	USA	9	16	37000	North Carolina	bb	USA	9	16	37000	New Jersey	
	Kirishima	Kongo	1915	Kirishima	Kongo	1915	Renown	bc	Britain	6	15	32000	Renown	bc	Britain	6	15	32000	Wisconsin	
	Kongo	Kongo	1913	Kongo	Kongo	1913	Revenge	bb	Britain	8	15	29000	Revenge	bb	Britain	8	15	29000	Yamato	
	Missouri	lowa	1935	Missouri	lowa	1935	Tennessee	bb	USA	12	14	32000	Tennessee	bb	USA	12	14	32000		
	Musashi	Yamato	1942	Musashi	Yamato	1942	Yamato	bb	Japan	9	18	65000	Yamato	bb	Japan	9	18	65000		
	New Jersey	lowa	1936	New Jersey	lowa	1936														
	North Carolina	North Carolina	1941	North Carolina	North Carolina	1941														
	Ramillies	Revenge	1917	Ramillies	Revenge	1917														
	Renown	Renown	1916	Renown	Renown	1916														
	Repulse	Renown	1916	Repulse	Renown	1916														
	Resolution	Revenge	1916	Resolution	Revenge	1916														
	Revenge	Revenge	1916	Revenge	Revenge	1916														
	Royal Oak	Revenge	1916	Royal Oak	Revenge	1916														
	Royal Sovereign	Revenge	1916	Royal Sovereign	Revenge	1916														
	Tennessee	Tennessee	1915	Tennessee	Tennessee	1915														
	Washington	North Carolina	1941	Washington	North Carolina	1941														
	Wisconsin	lowa	1940	Wisconsin	lowa	1940														
	Yamato	Yamato	1941																	



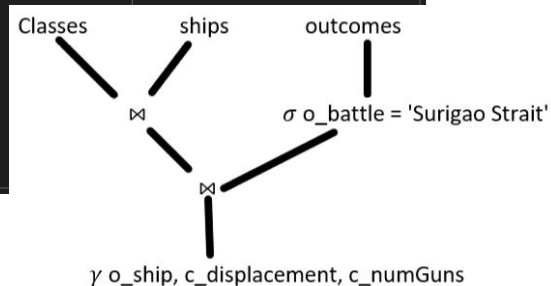
## 5. List the name, displacement, and number of guns of the ships engaged in the battle of Surigao Strait

	classes						ships			outcomes			$\sigma$ o_battle = 'Surigao Strait'			R = $\Pi$ o_ship, c_displacement, c_numGuns		
Schema	(c_class, c_type, c_country, c_numGun, c_bore, c_displacement)						(s_name, s_class, s_launched)			(o_ship, o_battle, o_result)			(o_ship, o_battle, o_result)			(o_ship, c_displacement, c_numGuns)		
Tuples	c_class	c_type	c_country	c_numGun	c_bore	c_displacement	s_name	s_class	s_launched	o_ship	o_battle	o_result	o_ship	o_battle	o_result	o_ship	c_displacement	c_numGuns
	Bismarck	bb	Germany	8	15	42000	California	Tennessee	1915	California	Surigao Strait	ok	California	Surigao Strait	ok	California	32000	12
	Iowa	bb	USA	9	16	46000	Haruna	Kongo	1915	Kirishima	Guadalcanal	sunk	Kirishima	Guadalcanal	sunk	California	32000	12
	Kongo	bc	Japan	8	14	32000	Hiei	Kongo	1915	Resolution	Denmark Strait	ok	Resolution	Denmark Strait	ok	New Jersey	46000	9
	North Carolina	bb	USA	9	16	37000	Iowa	Iowa	1933	Wisconsin	Guadalcanal	damage d	Wisconsin	Guadalcanal	damage d	Tennessee	32000	12
	Renown	bc	Britain	6	15	32000	Kirishima	Kongo	1915	Tennessee	Surigao Strait	ok	Tennessee	Surigao Strait	ok	Wisconsin	46000	9
	Revenge	bb	Britain	8	15	29000	Kongo	Kongo	1913	Washington	Guadalcanal	ok	Washington	Guadalcanal	ok	Yamato	65000	9
	Tennessee	bb	USA	12	14	32000	Missouri	Iowa	1935	New Jersey	Surigao Strait	ok	New Jersey	Surigao Strait	ok			
	Yamato	bb	Japan	9	18	65000	Musashi	Yamato	1942	Yamato	Surigao Strait	sunk	Yamato	Surigao Strait	sunk			
							New Jersey	Iowa	1936	Wisconsin	Surigao Strait	damage d	Wisconsin	Surigao Strait	damage d			
							North Carolina	North Carolina	1941									
							Ramillies	Revenge	1917									
							Renown	Renown	1916									
							Repulse	Renown	1916									
							Resolution	Revenge	1916									
							Revenge	Revenge	1916									
							Royal Oak	Revenge	1916									
							Royal Sovereign	Revenge	1916									
							Tennessee	Tennessee	1915									
							Washington	North Carolina	1941									
							Wisconsin	Iowa	1940									
							Yamato	Yamato	1941									

```

SELECT o_ship, c_displacement, c_numGuns
FROM classes, outcomes, ships
WHERE c_class = s_class
      AND s_name = o_ship
      AND o_battle = 'Surigao Strait'
GROUP BY o_ship;

```

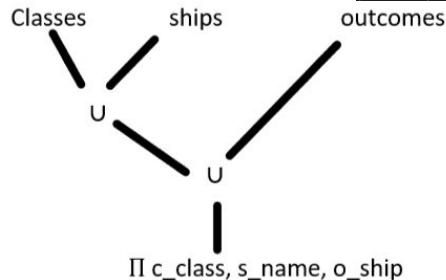




6. List the name of all the ships from the database. Ships appear in Ships, Classes, and Outcomes tables. All of them have to be printed.

```
SELECT c_class
FROM classes
UNION
SELECT s_name
FROM ships
UNION
SELECT o_ship
FROM outcomes;
```

	classes						ships			outcomes			R = Π c_class, s_name, o_ship	
Schema	(c_class, c_type, c_country, c_numGun, c_bore, c_displacement)						(s_name, s_class, s_launched)			(o_ship, o_battle, o_result)			(c_class, s_name, o_ship)	
Tuples	c_class	c_type	c_country	c_numGuns	c_bore	c_displacement	s_name	s_class	s_launched	o_ship	o_battle	o_result	c_class	
	Bismarck	bb	Germany	8	15	42000	California	Tennessee	1915	California	Surigao Strait	ok	Bismarck	
	Iowa	bb	USA	9	16	46000	Haruna	Kongo	1915	Kirishima	Guadalcanal	sunk	California	
	Kongo	bc	Japan	8	14	32000	Hiei	Kongo	1915	Resolution	Denmark Strait	ok	Haruna	
	North Carolina	bb	USA	9	16	37000	Iowa	Iowa	1933	Wisconsin	Guadalcanal	damaged	Hiei	
	Renown	bc	Britain	6	15	32000	Kirishima	Kongo	1915	Tennessee	Surigao Strait	ok	Iowa	
	Revenge	bb	Britain	8	15	29000	Kongo	Kongo	1913	Washington	Guadalcanal	ok	Kirishima	
	Tennessee	bb	USA	12	14	32000	Missouri	Iowa	1935	New Jersey	Surigao Strait	ok	Kongo	
	Yamato	bb	Japan	9	18	65000	Musashi	Yamato	1942	Yamato	Surigao Strait	sunk	Missouri	
							New Jersey	Iowa	1936	Wisconsin	Surigao Strait	damaged	Musashi	
							North Carolina	North Carolina	1941				New jersey	
							Ramillies	Revenge	1917				North Carolina	
							Renown	Renown	1916				Ramillies	
							Repulse	Renown	1916				Renown	
							Resolution	Revenge	1916				Repulse	
							Revenge	Revenge	1916				Resolution	
							Royal Oak	Revenge	1916				Revenge	
							Royal Sovereign	Revenge	1916				Royal Oak	
							Tennessee	Tennessee	1915				Royal Sovereign	
							Washington	North Carolina	1941				Tennessee	
						Wisconsin	Iowa	1940				Washington		
						Yamato	Yamato	1941				Wisconsin		
												Yamato		



## 7. Find the classes that have exactly two ships in the class.

```
SELECT s_class
FROM ships
GROUP BY s_class
HAVING count(s_class) = 2;
```

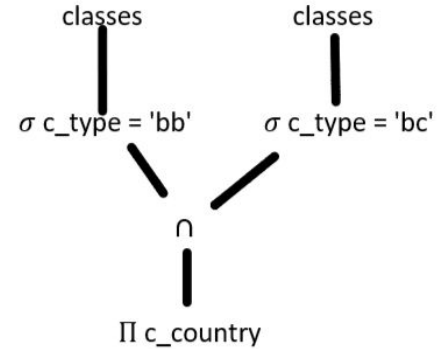
ships  
 $\gamma$  s\_class  
 $\sigma$  count(s\_class) = 2

	Ships			$\gamma$ s_class	$\sigma$ count(s_class) = 2			R = $\Pi$ s_class
Schema	(s_name, s_class, s_launched)			(s_class)	(s_name, s_class, s_launched)			(s_class)
Tuples	s_name	s_class	s_launched	s_class	s_name	s_class	s_launched	s_class
	California	Tennessee	1915	Iowa	California	Tennessee	1915	North Carolina
	Haruna	Kongo	1915	Kongo	<del>Haruna</del>	<del>Kongo</del>	<del>1915</del>	Renown
	Hiei	Kongo	1915	North Carolina	<del>Hiei</del>	<del>Kongo</del>	<del>1915</del>	Tennessee
	Iowa	Iowa	1933	Renown	<del>Iowa</del>	<del>Iowa</del>	<del>1933</del>	Yamato
	Kirishima	Kongo	1915	Revenge	<del>Kirishima</del>	<del>Kongo</del>	<del>1915</del>	
	Kongo	Kongo	1913	Tennessee	<del>Kongo</del>	<del>Kongo</del>	<del>1913</del>	
	Missouri	Iowa	1935	Yamato	<del>Missouri</del>	<del>Iowa</del>	<del>1935</del>	
	Musashi	Yamato	1942		Musashi	Yamato	1942	
	New Jersey	Iowa	1936		<del>New Jersey</del>	<del>Iowa</del>	<del>1936</del>	
	North Carolina	North Carolina	1941		North Carolina	North Carolina	1941	
	Ramillies	Revenge	1917		<del>Ramillies</del>	<del>Revenge</del>	<del>1917</del>	
	Renown	Renown	1916		Renown	Renown	1916	
	Repulse	Renown	1916		Repulse	Renown	1916	
	Resolution	Revenge	1916		<del>Resolution</del>	<del>Revenge</del>	<del>1916</del>	
	Revenge	Revenge	1916		<del>Revenge</del>	<del>Revenge</del>	<del>1916</del>	
	Royal Oak	Revenge	1916		<del>Royal Oak</del>	<del>Revenge</del>	<del>1916</del>	
	Royal Sovereign	Revenge	1916		<del>Royal Sovereign</del>	<del>Revenge</del>	<del>1916</del>	
	Tennessee	Tennessee	1915		Tennessee	Tennessee	1915	
	Washington	North Carolina	1941		Washington	North Carolina	1941	
	Wisconsin	Iowa	1940		<del>Wisconsin</del>	<del>Iowa</del>	<del>1940</del>	
	Yamato	Yamato	1941		Yamato	Yamato	1941	



## 8. Find the countries that have both bb and bc ships.

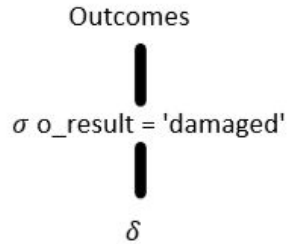
```
SELECT c_country
FROM classes
WHERE c_type = 'bb'
INTERSECT
SELECT c_country
FROM classes
WHERE c_type = 'bc';
```



Schema	classes (c_class, c_type, c_country, c_numGun, c_bore, c_displacement)						$\sigma_{c\_type = 'bb'}$ (c_class, c_type, c_country, c_numGun, c_bore, c_displacement)						$\sigma_{c\_type = 'bc'}$ (c_class, c_type, c_country, c_numGun, c_bore, c_displacement)						$R = \Pi_{c\_country}$ (c_country)	
Tuples	c_class	c_type	c_country	c_numGuns	c_bore	c_displacement	c_class	c_type	c_country	c_numGuns	c_bore	c_displacement	c_class	c_type	c_country	c_numGuns	c_bore	c_displacement	<div> <div>Britain</div> <div>Japan</div> </div>	
	Bismarck	bb	Germany	8	15	42000	Bismarck	bb	Germany	8	15	42000	Bismarck	bb	Germany	8	15	42000		
	Iowa	bb	USA	9	16	46000	Iowa	bb	USA	9	16	46000	Iowa	bb	USA	9	16	46000		
	Kongo	bc	Japan	8	14	32000	Kongo	bc	Japan	8	14	32000	Kongo	bc	Japan	8	14	32000		
	North Carolina	bb	USA	9	16	37000	North Carolina	bb	USA	9	16	37000	North Carolina	bb	USA	9	16	37000		
	Renown	bc	Britain	6	15	32000	Renown	bc	Britain	6	15	32000	Renown	bc	Britain	6	15	32000		
	Revenge	bb	Britain	8	15	29000	Revenge	bb	Britain	8	15	29000	Revenge	bb	Britain	8	15	29000		
	Tennessee	bb	USA	12	14	32000	Tennessee	bb	USA	12	14	32000	Tennessee	bb	USA	12	14	32000		
	Yamato	bb	Japan	9	18	65000	Yamato	bb	Japan	9	18	65000	Yamato	bb	Japan	9	18	65000		

9. Find the ships that survived a battle in which they were damaged and then fought in another battle.

```
SELECT DISTINCT o_ship
FROM outcomes
WHERE o_result = 'damaged';
```



	outcomes			$\sigma_{o\_result = 'damaged'}$			$\delta$	$R = \Pi$
Schema	(o_ship, o_battle, o_result)			(o_ship, o_battle, o_result)				(o_ship)
Tuples	o_ship	o_battle	o_result	o_ship	o_battle	o_result	o_ship	o_ship
	California	Surigao Strait	ok	<del>California</del>	<del>Surigao Strait</del>	<del>ok</del>	<del>Wisconsin</del>	Wisconsin
	Kirishima	Guadalcanal	sunk	<del>Kirishima</del>	<del>Guadalcanal</del>	<del>sunk</del>	Wisconsin	
	Resolution	Denmark Strait	ok	<del>Resolution</del>	<del>Denmark Strait</del>	<del>ok</del>		
	Wisconsin	Guadalcanal	damaged	Wisconsin	Guadalcanal	damaged		
	Tennessee	Surigao Strait	ok	<del>Tennessee</del>	<del>Surigao Strait</del>	<del>ok</del>		
	Washington	Guadalcanal	ok	<del>Washington</del>	<del>Guadalcanal</del>	<del>ok</del>		
	New Jersey	Surigao Strait	ok	<del>New Jersey</del>	<del>Surigao Strait</del>	<del>ok</del>		
	Yamato	Surigao Strait	sunk	<del>Yamato</del>	<del>Surigao Strait</del>	<del>sunk</del>		
	Wisconsin	Surigao Strait	damaged	Wisconsin	Surigao Strait	damaged		

10. For every class with at least three ships, find the number of ships of that class sunk in battle. If a class has zero sunk ships, this number has to be included in the result together with the class

```
SELECT M.s_class, COUNT(o_result)
FROM
  (SELECT s_class, s_name
   FROM ships
   WHERE s_class IN
     (SELECT s_class
      FROM ships
      GROUP BY s_class
      HAVING COUNT(s_class) >= 3) ) M
LEFT JOIN
  (SELECT o_ship, o_result
   FROM outcomes
   WHERE o_result = 'sunk') S ON M.s_name = S.o_ship
GROUP BY M.s_class
```

