

CPSC 304 Project Cover Page

Milestone #: __4__

Date: __Aug 5, 2024__

Group Number: __35__

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By typing our names and student numbers in the above table, we certify that the work in the attached assignment was performed solely by those whose names and student IDs are included above. (In the case of Project Milestone 0, the main purpose of this page is for you to let us know your e-mail address, and then let us assign you to a TA for your project supervisor.)

In addition, we indicate that we are fully aware of the rules and consequences of plagiarism, as set forth by the Department of Computer Science and the University of British Columbia

Repository Link

https://github.students.cs.ubc.ca/CPSC304-2024S-T2/project_f0q8k_g6d6m_q1p2n

Project Description

Our project focuses on astronomy, tracking data of celestial bodies like stars, planets, and moons, storing parameters such as mass and diameter. It models star and planetary systems with real-world statistics and simple visualizations. This tool can be used by educational institutions to teach about star systems and modern astronomical research methods. We can add stars and planets, delete stars, update stars, search for entries and display its attributes using the provided criteria. Given a star name, we can display all its planets, and given a minimum planet count, we can display all stars which have more than that number of planets. Given a minimum mass, we can display the average diameters of blackholes above that mass, grouped by mass. We can display stars which have all asteroids.

Final schema is the same as in milestone #2:

Planet_Densities(equatorial_diameter: FLOAT, mass: FLOAT, density: FLOAT)
PK: (equatorial_diameter, mass)

Planet(planet_name: VARCHAR(100), **equatorial_diameter**: FLOAT, **mass**: FLOAT, ESI: FLOAT, discovery_method: VARCHAR(100), rotation_period: FLOAT)
PK: planet_name, FK: (equatorial_diameter, mass) referencing Planet_Densities(equatorial_diameter, mass)

NeutronStar_Density_EscapeVelocity(mass: FLOAT, diameter: FLOAT, density: FLOAT, escape_velocity: FLOAT)
PK: (mass, diameter)

NeutronStar(neutron_star_name: VARCHAR(100), luminosity: FLOAT, rotation_period: FLOAT, **mass**: FLOAT, **diameter**: FLOAT, **star_name**: VARCHAR(100))
PK: neutron_star_name, FK: (mass, diameter) referencing NeutronStar_Density_EscapeVelocity(mass, diameter), star_name referencing Star(star_name)

BlackHole_Diameter(mass: FLOAT, rotation_period: FLOAT, diameter: FLOAT)
PK: (mass, rotation_period)

BlackHole(black_hole_name: VARCHAR(100), **mass**: FLOAT, **rotation_period**: FLOAT)

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PK: black_hole_name, FK: (mass, rotation_period) referencing BlackHole_Diameter
Moon(moon_name: VARCHAR(100), **planet_name**: VARCHAR(100) NOT NULL, distance_to_planet: FLOAT NOT NULL, ESI: FLOAT, mass: FLOAT, PM_eccentricity: FLOAT, rotation_period: FLOAT)
PK: moon_name, FK: planet_name referencing Planet(planet_name), planet_name can't be null

OrbitingPlanet(**planet_name**: VARCHAR(100), orbital_period: FLOAT, distance_to_centre: FLOAT, **white_dwarf_name**: VARCHAR(100), WDP_eccentricity: FLOAT, **star_name**: VARCHAR(100), SP_eccentricity: FLOAT, **neutron_star_name**: VARCHAR(100), NSP_eccentricity: FLOAT)
PK: planet_name, FK: planet_name referencing Planet(planet_name), white_dwarf_name referencing WhiteDwarf(white_dwarf_name), star_name referencing Star(star_name), neutron_star_name referencing NeutronStar(neutron_star_name)

Star(R1-star_name: VARCHAR(100), **R2-star_name**: VARCHAR(100) UNIQUE, luminosity: FLOAT, rotation_period: FLOAT, diameter: FLOAT, mass: FLOAT, orbital_eccentricity: FLOAT, orbital_period: FLOAT, distance_to_companion: FLOAT, **black_hole_name**: VARCHAR(100))
PK: star_name, FK: black_hole_name referencing BlackHole(black_hole_name), R2-star_name referencing Star(star_name), R2-star_name need to be unique

FreeFloatingPlanet(**planet_name**: VARCHAR(100), proper_motion: FLOAT)
PK: planet_name, FK: planet_name referencing Planet(planet_name)

MainSequenceStar(star_name: VARCHAR(100), class: VARCHAR(100))
PK: star_name, FK: star_name referencing Star(star_name)

RedGiant(**star_name**: VARCHAR(100), pulsation_period: FLOAT)
PK: star_name, FK: star_name referencing Star(star_name)

Asteroid(asteroid_name: VARCHAR(100), orbital_period: FLOAT, diameter: FLOAT, mass: FLOAT, **star_name**: VARCHAR(100), AS_eccentricity: FLOAT, **planet_name**: VARCHAR(100))
PK: asteroid_name, FK: star_name referencing Star(star_name), planet_name referencing OrbitingPlanet(planet_name)

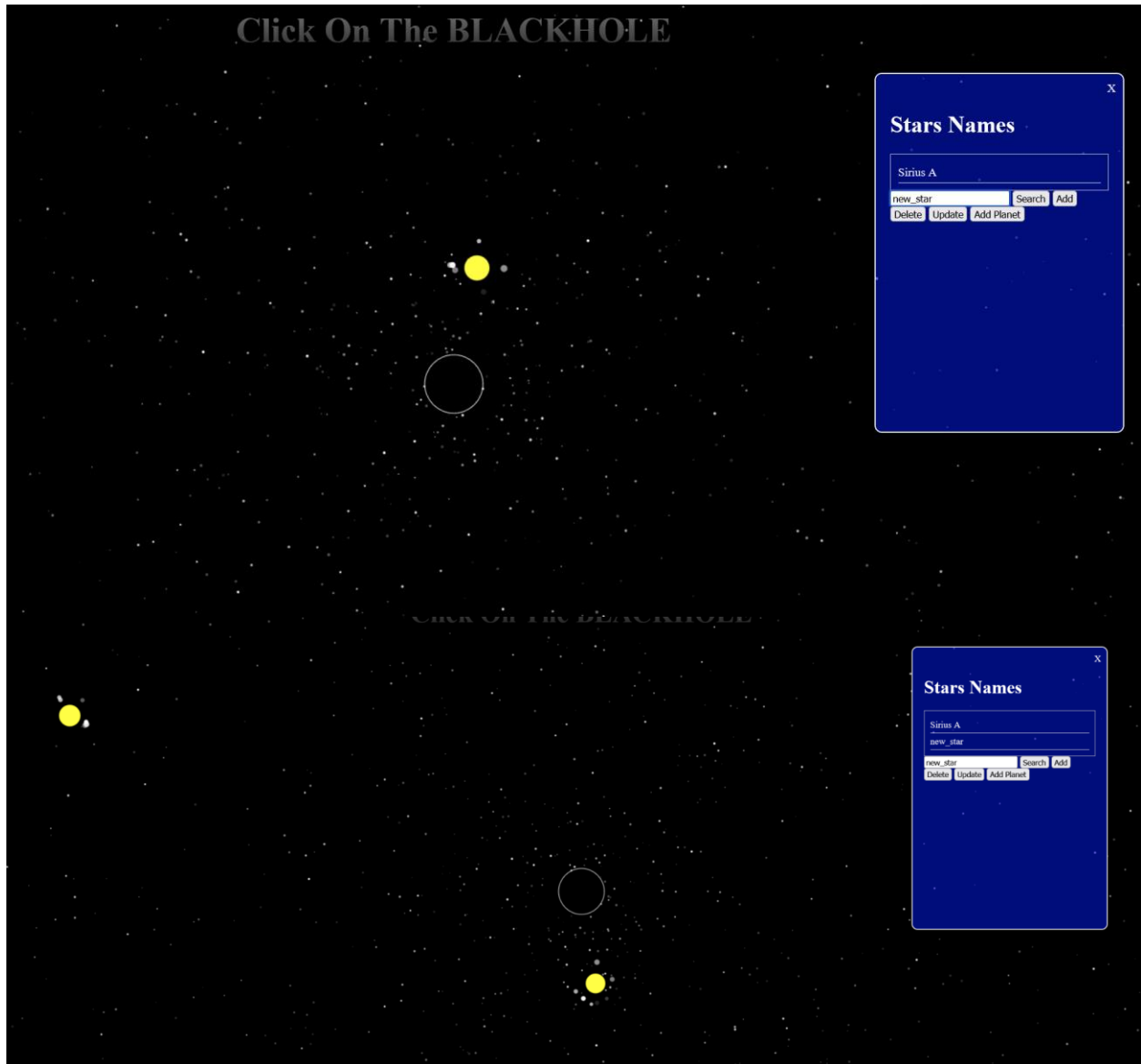
WhiteDwarf(white_dwarf_name: VARCHAR(100), rotation_period: FLOAT, luminosity: FLOAT, mass: FLOAT, diameter: FLOAT, density: FLOAT, metallicity: FLOAT, **star_name**: VARCHAR(100) UNIQUE)
PK: WDName, FK: companion_star referencing Star(star_name), star_name need to be unique

SQL script:

In project.sql

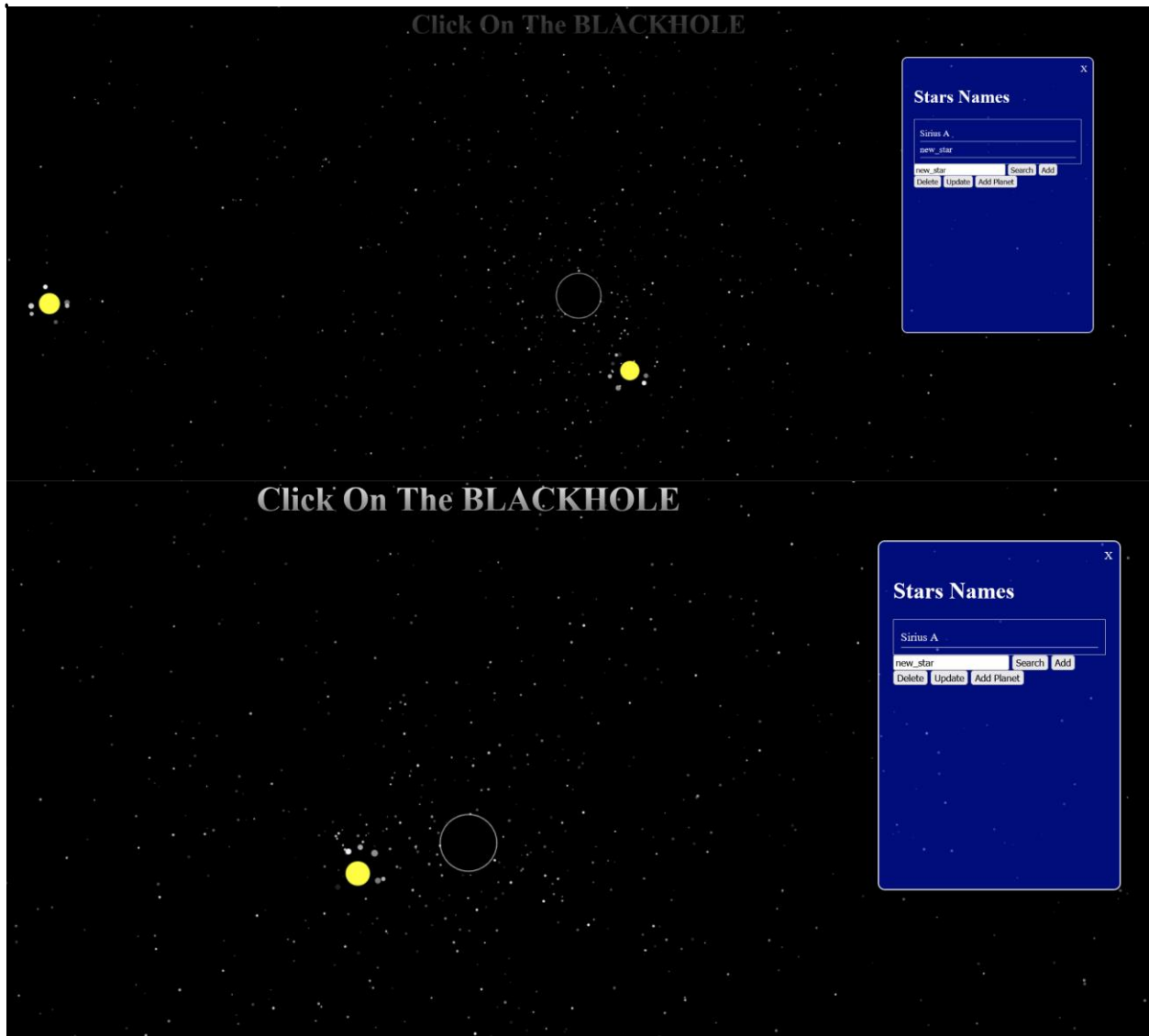
Screenshots:

INSERT



Line 125 in appController, line 264 in appService
added a star called new_star to stars, orbiting the blackhole M87*

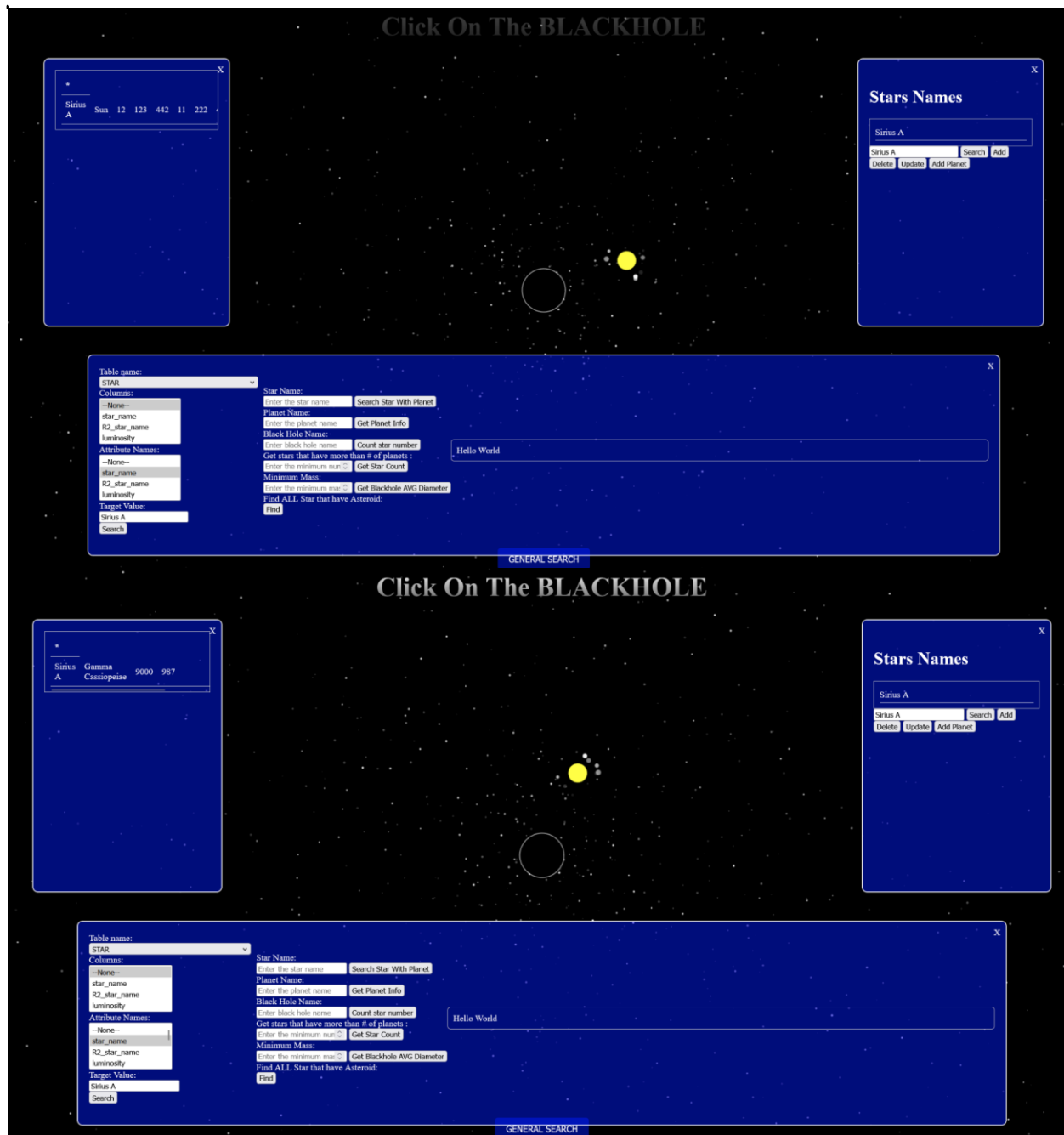
DELETE



Line 140 in appController, line 264 in appService
Deleted new_star.

UPDATE

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Line 329 in appController, line 499 in appService

Updated Sirius A, changing attributes such as companion star (went from Sun to Gamma Cassiopeiae). See star details on the left side.

Selection

Click On The BLACKHOLE

×

☆

Betelgeuse	Rigel	1.26e+31	8.4	8600
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Table name:

STAR

Columns:

☐ star_name

☐ R2_star_name

☐ luminosity

☐ rotation_period

☐ diameter

☐ mass

☐ orbital_eccentricity

☐ orbital_period

☐ distance_to_companion

☐ black_hole_name

Attribute Names:

☐ star_name

☐ R2_star_name

☐ luminosity

☐ rotation_period

☐ diameter

☒ mass

☐ orbital_eccentricity

☐ orbital_period

☐ distance_to_companion

☐ black_hole_name

Target Value:

1.76e+31

Search

Star Name:

Enter the star name

Search Star With Planet

Planet Name:

Enter the planet name

Get Planet Info

Black Hole Name:

Enter black hole name

Count star number

Get stars that have more than # of planets :

Enter the minimum n

Get Star Count

Minimum Mass:

Enter the minimum m

Get Blackhole AVG Diameter

Find ALL Star that have Asteroid:

Find

Hello World

line 423 in appService, line 270 in appController

Select Attribute name "mass", where mass = 1.76e+31

Show all attributes in the left information board.(if you click columns, you can select what columns to be returned).

Projection

Click On The BLACKHOLE

black_hole_name	mass
Cygnus X-1	10
Sagittarius A*	15
V404 Cygni	12
M87*	20
A0620-00	8
GRO J1655-40	25
GS 1124-683	30
GRS 1915+105	18

Table name:
BLACKHOLE

Columns:
☒ black_hole_name
☒ mass
☐ rotation_period

Attribute Names:
☐ black_hole_name
☐ mass
☐ rotation_period

Target Value:
Enter the Target Value

Star Name:
Enter the star name

Planet Name:
Enter the planet name

Black Hole Name:
Enter black hole name

Get stars that have more than # of planets :
Enter the minimum n

Minimum Mass:
Enter the minimum m

Find ALL Star that have Asteroid:

GENERAL SEARCH

line 423 in appService, line 270 in appController.

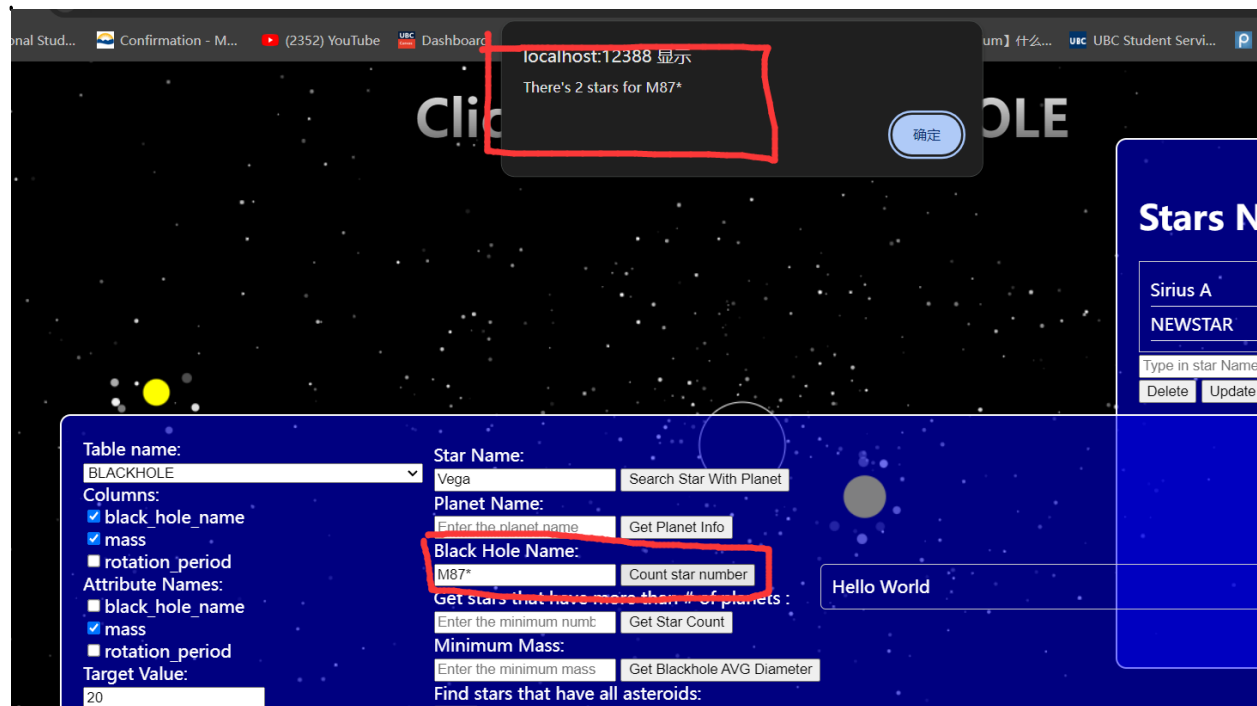
Select BlackHole table, and select black_hole_name and mass columns. Show the all content in the table of these two columns.

Join



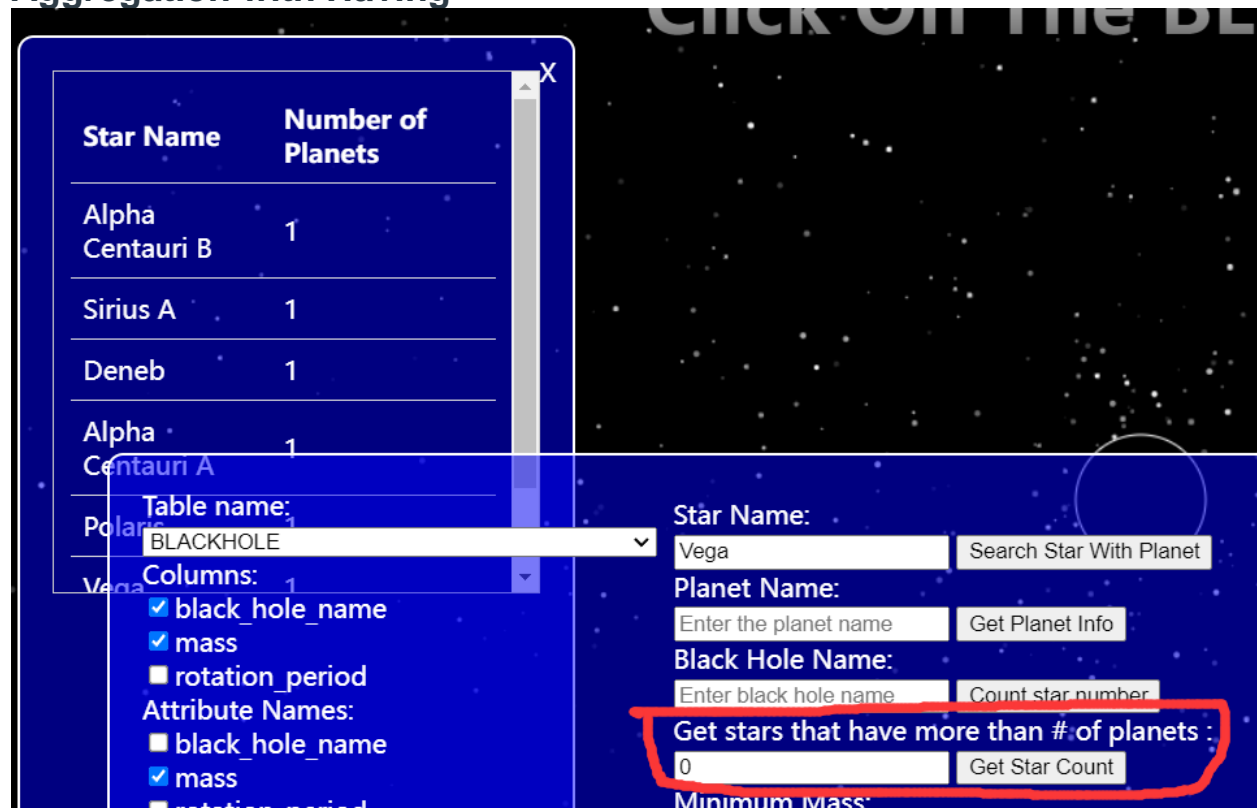
Joins star and orbiting planet table.
line 165 in appController, 349 in appController

Aggregation with Group By



line 151 in appController, line 317 in appService

Aggregation with Having



Line 234 in appController

Nested Aggregation with Group By

Mass	Average Diameter
22	55
25	35
30	65

Table name: BLACKHOLE

Columns:
☒ black_hole_name
☒ mass
☐ rotation_period

Attribute Names:
☐ black_hole_name
☐ mass
☐ rotation_period

Target Value:
20
Search

Star Name: Vega Search Star With Planet

Planet Name: Enter the planet name Get Planet Info

Black Hole Name: M87* Count star number

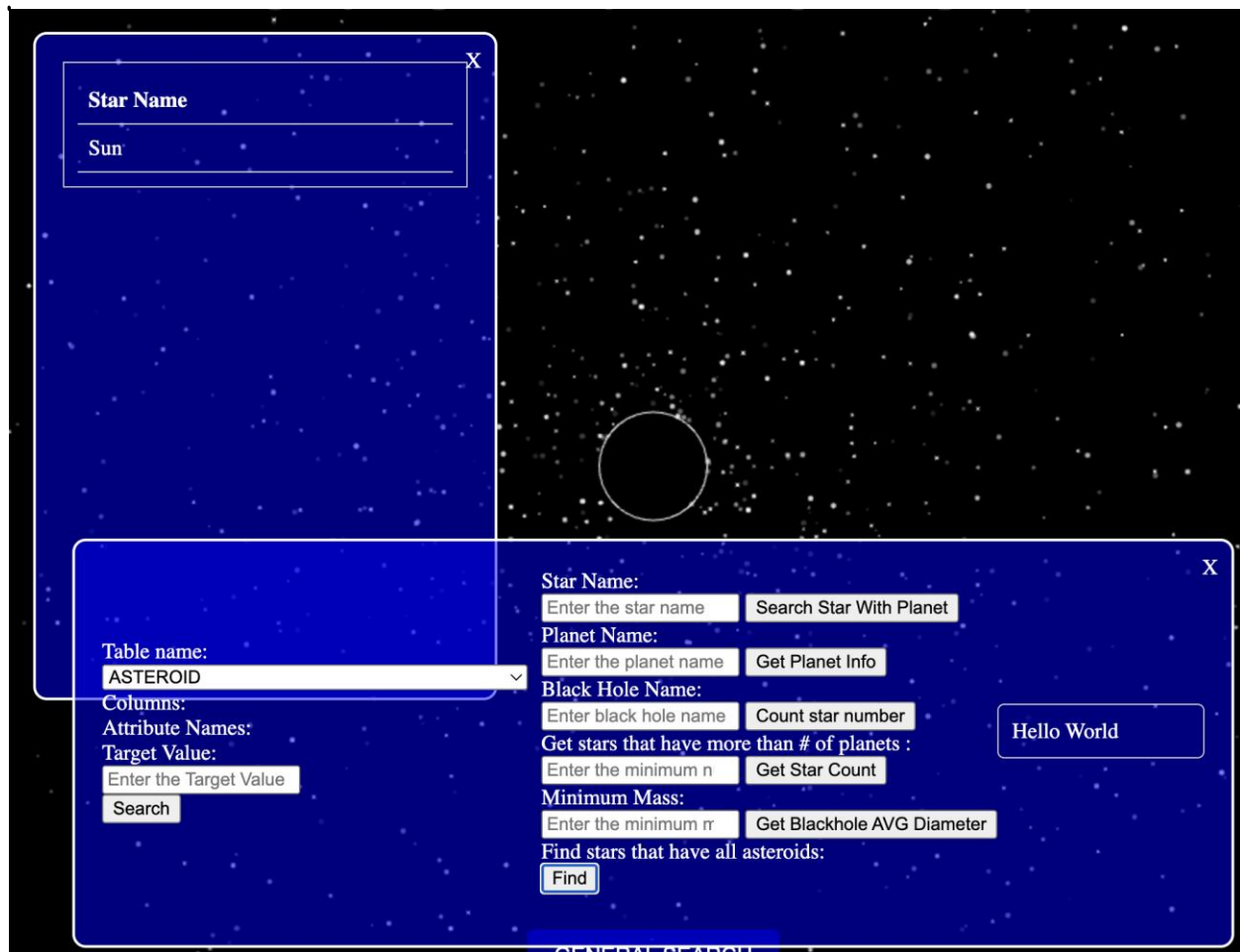
Get stars that have more than # of planets : Enter the minimum numb. Get Star Count

Minimum Mass: 20 Get Blackhole AVG Diameter

~~Find stars that have all asteroids:~~ Find

Line 302 in appController

Division



Line 258 in appController.js, Line 451 in appService.js

The bottom button, “Find”, will find the star that has all asteroids, since all asteroids orbits from “Sun”, then it shows the name of “Sun”.

Data in each relation:

asteroid_n	orbital_per	diameter	mass	star_name	AS_eccentr	planet_name
Ceres	1680	946	9.3834999E+18	Sun	7.4999999999999997E-2	
Eros	1.76	16.800000	6.69E+18	Sun	0.22	Mars
Euphrosyne	1735	282	6.6E+19	Sun	0.20999999999999999	
Hebe	5.1399999	0.4000000	8.2E+18	Sun	8.0000000E-2	Saturn
Hygiea	2035	431	8.67E+19	Sun	0.1170000E-2	Saturn
Juno	1730	258	5.59E+19	Sun	9.7000000E-2	Earth
Pallas	1685	512	2.04E+20	Sun	0.2300000E-2	Mars
Psyche	1500	226	4.1E+19	Sun	0.11	Saturn
Vesta	1325	525	2.59E+20	Sun	8.8999999E-2	Saturn

black_hole.mass	rotation_period
A0620-00 8	0.6999999999999996
Cygnus X-1 10	0.5
GRO J1655 25	0.20000000000000001
GRS 1915+ 18	0.40000000000000002
GS 1124-68 30	0.80000000000000004
LMC X-1 22	0.5
M87* 20	0.29999999999999999
Sagittarius 15	0.40000000000000002
V404 Cygni 12	0.5999999999999998
XTE J1118+ 11	0.5999999999999998

mass	rotation_p	diameter
8	0.6999999	70
10	0.5	60
11	0.5999999	52
12	0.5999999	50
15	0.4000000	45
18	0.4000000	48
20	0.2999999	40
22	0.5	55
25	0.2000000	35
30	0.8000000	65

planet_nam	proper_motion
Aether	0.0038
Gorgona	3.599999999999999E-3
Novae	3.099999999999999E-3
Orionis	2.7000000000000001E-3
Zircon	4.199999999999997E-3

star_name	class
Alpha Cent	G2V
Altair	A7V
Procyon A	F5IV-V
Sirius A	A1V
Vega	A0V

moon_name	planet_name	distance_to_ESI	mass	PM_eccentricity	rotation_period
Callisto	Jupiter	1882700	0.5500000	1.0799999	16.690000000000001
Deimos	Mars	23460	2.9999999	148000000	5.0000000
Europa	Jupiter	670900	0.6700000	4.8E+22	9.4000000
Ganymede	Jupiter	1070400	0.62	1.4799999	7.1500000000000004
Iapetus	Saturn	3560820	0.2999999	1.81E+21	79.29999999999997
Io	Jupiter	421800	0.5799999	4.1500000	4.1000000
Moon	Earth	384400	0.5600000	7.3500000	5.4899999
Phobos	Mars	9377	0.1000000	1.08E+16	1.4999999
Rhea	Saturn	527580	0.2999999	2.31E+21	0.027
Titan	Saturn	1221870	0.62	1.3499999	2.8000000

planet_name	orbital_per	distance_tc	white_dwa	WDP_eccen	star_name	SP_eccentr	neutron_st	NSP_eccentricity
Earth	365.25	149600000	Sirius B	0.01	Alpha Cent	1.4999999999999999E-2		
Jupiter	4332.5900	778300000	Altair B	5.0000000	Sirius A	1.7000000000000001E-2		
Mars	687	227900000	Procyon B	0.02	Alpha Cent	0.014		
Neptune	60190.029	449500000	Alpha Cent	0.01	Polaris	0.014		
Pluto	90560	590600000	Beta Cancr	5.0000000	Deneb	1.7999999999999999E-2		
Poltergeist	27.300000	384400000			Pulsar B	0.014		
Saturn	10759.219	142900000	Vega B	2.9999999	Vega	1.2999999999999999E-2		
Uranus	30687.150	287100000	Epsilon Eric	0.02	Altair	0.016		

planet_name	equatorial_mass	ESI	discovery_method	rotation_period
Aether	88000	1.1E+26	0.7800000(Astrometry	15.4
Earth	12742	5.9720000(0.9300000(Radial Velo	24	
Europa	4900	4.8E+22	0.9000000(Flyby	3.5499999999999998
Ganymede	139822	1.8979999(0.9200000(Flyby	7.1500000000000004	
Gorgona	10500	6.2000000(0.8000000(Transit	28.5	
Jupiter	142984	1.8979999(0.8100000(Direct Image	9.9000000000000004	
Mars	6792	6.3899999(0.6400000(Transit	24.600000000000001	
Moon	3475	7.3500000(0.9100000(Radar	27.300000000000001	
Neptune	49528	1.0239999(0.6500000(Astrometry	16.100000000000001	
Novae	62000	8.5000000(0.7600000(Occultation	20.899999999999999	
Orionis	150000	2.4999999(0.8499999(Microlensing	12.300000000000001	
Pluto	2370	1.3E+22	0.5699999(Occultation	153.30000000000001
Poltergeist	4800	1.0799999(0.8900000(Flyby	16.690000000000001	
Saturn	120536	5.6830000(0.7299999(Microlensing	10.699999999999999	
Uranus	51118	8.6810000(0.6099999(Transit	17.199999999999999	
Zircon	9200	3.9999999(0.7199999(Direct Image	30.100000000000001	

	equatorial_mass	density
2370	1.3E+22	2100
3475	7.35000000	3340
4800	1.07999999	2900
4900	4.8E+22	3010
6792	6.38999999	3933
9200	3.99999999	4300
10500	6.20000000	5700
12742	5.97200000	5514
49528	1.02399999	1638
51118	8.68100000	1271
62000	8.50000000	1400
88000	1.1E+26	1250
120536	5.68300000	687
139822	1.89799999	1326
142984	1.89799999	1326
150000	2.49999999	1350

star_name	pulsation_period
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Aldebaran	645
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Antares	1730
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Arcturus	271
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Betelgeuse	400
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Delta Scorpi	560
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Gamma Ca	350
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Mu Cephei	850
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Nu Scorpii	400
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Pollux	590
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Rho Cassio	600
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star_name	R2_star_na	luminosity	rotation_p	diameter	mass	orbital_ecc	orbital_per	distance_t	black_hole_name
Aldebaran		643	44200000	1.1599999	0.267000000000000002				Sagittarius A*
Alpha Cent	Alpha Cent	1.519E+26	22	122700000	2.1870000	0	79.909999	23500000	Cygnus X-1
Alpha Cent	Alpha Cent	1.519E+26	22	122700000	2.1870000	0	79.909999	23500000	Sagittarius A*
Altair	Vega	1.47E+27	9.9000000	188000000	2.1349999	0	150	930000000	GRS 1915+105
Antares		643	44200000	1.1599999	0.267000000000000002				Sagittarius A*
Arcturus		170	35300000	1.1E+30	0.267000000000000002				Sagittarius A*
Betelgeuse	Rigel	1.26E+31	8.4000000	860000000	1.76E+31	0	233.75	548700000	V404 Cygni
Delta Scorpii		560	8000000	1.4999999	0.267000000000000002				Sagittarius A*
Deneb	Polaris	5.1000000	18	230000000	5.0260000	0	365	180000000	XTE J1118+480
Gamma Cassiopeiae		20000	78900000	1.8E+31	0.267000000000000002				Sagittarius A*
Mu Cephei		850	142000000	1.9000000	0.267000000000000002				Sagittarius A*
Nu Scorpii		400	6600000	1.4000000	0.267000000000000002				Sagittarius A*
Polaris	Deneb	4.1999999	30	380000000	4.0259999	0	400	360000000	LMC X-1
Pollux		590	8800000	1.900000000000000001	0.267000000000000002				Sagittarius A*
Procyon A		6.9299999	23.100000	204800000	3.5000000	0	365.25	11400000	A0620-00
Rho Cassiopeiae		600	137000000	3.9999999	0.267000000000000002				Sagittarius A*
Rigel	Betelgeuse	2.6449999	10	780000000	3.9779999	0	360	470000000	GRO J1655-40
Sirius A		2.3639999	5.5	206200000	3.9779999	0	365.25	8600000	M87*
Sun		3.8459999	25.050000	139140000	1.9889999999999999E+30				
Vega	Altair	5.4500000	12.5	236200000	2.1349999	0	200	77000000	GS 1124-683

white_dwa	rotation_p	luminosity	mass	diameter	density	metallicity	star_name
Alpha Cent	0.5999999	3.0000000	6.9999999	15000	300000000	0.001	Alpha Centauri A
Altair B	0.9000000	0.001	1.3999999	17000	130000000	3.0000000	Altair
Beta Cancr	1.1000000	0.002	1.2E+30	14000	300000000	0.002	
Epsilon Eric	0.8000000	4.0000000	1E+30	16000	250000000	3.0000000000000000	1E-3
Procyon B	0.4000000	5.0000000	5.9999999	18000	8000000	0.002	Procyon A
Sirius B	1.3999999	5.6000000	1.02E+30	12200	290000000	0.001	Sirius A
Tau Ceti B	1.2	5.0000000	1.2999999	17000	320000000	3.0000000000000000	1E-3
Vega B	0.6999999	0.002	9.0000000	16000	310000000	0.002	Vega
Zeta Reticu	0.6999999	3.0000000	7.9999999	13000	280000000	0.002	

neutron_star	luminosity	rotation_period	mass	diameter	star_name
Pulsar A	1E+27	3.3000000	1.3999999	20	Alpha Centauri A
Pulsar B	5.0000000	4.3999999	2	15	Alpha Centauri B
Pulsar C	2.9999999	2.5000000	1.7	18	Betelgeuse
Pulsar D	2.5E+26	4.8000000	1.8999999	16	Procyon A
Pulsar E	4.0000000	2.9999999	1.5	19	Sirius A
Pulsar F	2.7999999	3.5999999	1.8	17	Rigel
Pulsar G	1.9000000	4.2000000	2.2000000	14	Vega
Pulsar H	3.5000000	3.7999999	1.6000000	19	Altair
Pulsar I	2.6999999	3.4000000	2.1000000	13	Polaris
Pulsar J	1.2E+27	4.0000000	1.3	21	Deneb

mass	diameter	density (kg	escape velocity (m/s)
1.4	20	4.50E+17	100000
2	15	6.00E+17	150000
1.7	18	5.00E+17	120000
1.9	16	5.80E+17	140000
1.5	19	4.70E+17	110000
1.8	17	5.60E+17	130000
2.2	14	6.20E+17	160000
1.6	19	4.90E+17	115000
2.1	13	6.10E+17	155000
1.3	21	4.40E+17	95000