**Name and surname***: Alicja Tomaszewska***Index: 191678**

**Topic of the project:**Astronomy: stars, planets, galaxies, constellations, etc.

**1.Task analysis:**

• customer: university, users: teachers and students at that university,

• purpose of the database:

to enable students and teachers at the university to do research about galaxies, constellations, stars, planets, moons and planetoids. Giving a possibility to students and teachers of doing observations of different objects in the space and then doing reports about them.

• possible scenarios of database use:

-planning observations,

-assigning people to do observations and reports about them

-doing observations about different object in the space taking into consideration needed equipment and atmospheric conditions of each observation,

-entering data about each observation to the database about observed objects( galaxy, planetoid, moon, planet, star or constellation)

-using information entered into database about observed objects to do reports,

• assumptions and limitations of the designed database:

-for a particular university

-not all objects in space can be observed (only galaxy, planetoid, moon, planet, star and constellation)

-changes in atmospheric conditions during particular observation cannot be taken into consideration, because only one type of atmospheric conditions are assigned to particular observations

• inquiries to the database:

-which objects (planetoids, moons, planets, stars, constellations) are part of particular galaxy,

-which moons circle around particular planet,

-which planets circle around particular star,

-which stars belong to particular constellation,

-what are the measurements of particular object,

-about what object observations are made,

-what are atmospheric conditions of each observation,

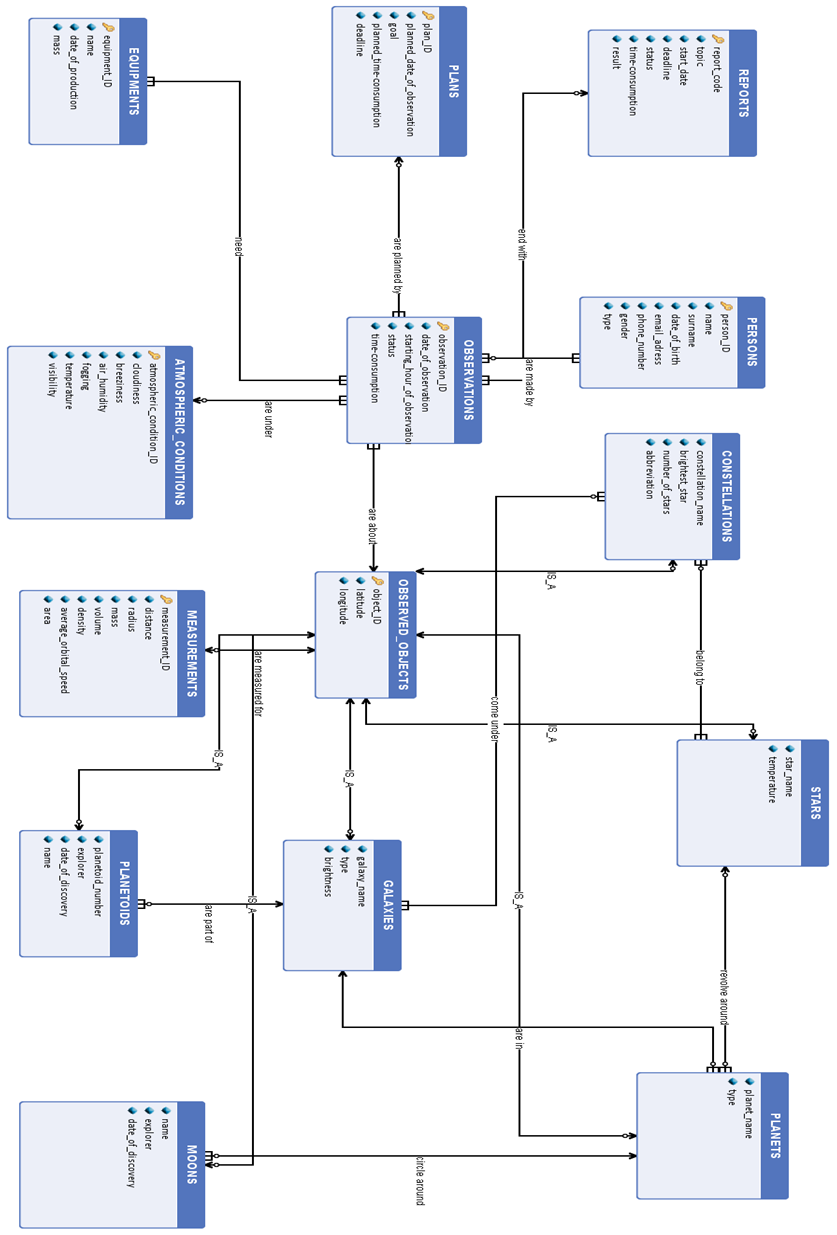
-what equipment is needed for particular observation,

-what is the plan for particular observation,

-which person is assigned to do particular observation

-what report is made about particular observation

**2. Diagram ERD**

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**3. Description of ERD diagram**

**Set of entities: PERSONS**Description: set of current and past people assigned to do observations, an entry is added when the new observation is made and the person to do that observation is needed, and might be deleted when the observation is cancelled or invalid; ~1000 entries

Attribute name: person\_IDMain key: YESDescription: enables to identify each person, 4 digits number, the numbers to the people are assigned in the order the person were added starting from 0001 counting upward

Attribute name: nameMain key: NODescription: the first name of each person, max 20 letters are allowed, only the first letter is capital

Attribute name: surnameMain key: NODescription: the last name of each person, max 30 letters are allowed, only the first letter is capital

Attribute name: date\_of\_birthMain key: NODescription: date of birth of a teacher or a student, each consist of 10 signs(8 digits and 2 '.' signs), the first two digits represent the day of the month, are separated by '.' sign from the next to digits, which represent the month, which are separated by '.' sign from 4 digits, which represent the year. Only past dates are allowed

Attribute name: email\_addressMain key: NODescription: e-mail address of teachers and students, max 50 signs can be entered, including letters, digits, and other special characters, the'@' sign must be used, the whitespaces are not allowed

Attribute name: phone\_numberMain key: NODescription: phone number of student or teacher, consists of 11 digits, where the first two digits represent country code, and other nine digits represents the proper phone number

Attribute name: genderMain key: NO Description: the gender of teacher or student, max 9 letters allowed, can be chosen from: 'male', 'female', 'nonbinary'

Attribute name: TypeMain key: NO Description: the function of each person at the university, consists of 7 letters, can be chosen from: 'teacher', 'student'

**Set of entities: REPORTS**Description: set of written reports, an entry is added when a new report about observation is made and might be deleted only if the mistakes in report are proved or the observation was invalid; ~1000 entries

Attribute name: report\_codeMain key: YES

Description: enables to identify each report, 4 digits number, the numbers to the reports are assigned in the order the reports were added starting from 0001 counting upward

Attribute name: topicMain key: NO Description: assigned to each observation based on the main field of activity, max 200 signs can be entered, including letters, digits, whitespace characters and other special characters

Attribute name: start\_dateMain key: NODescription: starting date of each report, each consist of 10 signs(8 digits and 2 '.' signs), the first two digits represent the day of the month, are separated by '.' sign from the next to digits, which represent the month, which are separated by '.' sign from 4 digits, which represent the year

Attribute name: deadlineMain key: NODescription: deadline of each report, each consist of 10 signs(8 digits and 2 '.' signs), the first two digits represent the day of the month, are separated by '.' sign from the next to digits, which represent the month, which are separated by '.' sign from 4 digits, which represent the year. Past dates are not allowed

Attribute name: statusMain key: NODescription: status of each report, can be chosen from: 'completed', 'in progress' and 'not started', so max 11 signs are needed including letters and white space

Attribute name: time-consumptionMain key: NO Description: the counted number of man-hours, max 4 digits number

Attribute name: resultMain key: NO Description: the main outcome of the observation, max 1000 signs can be entered, including letters, digits, whitespace characters and other special characters

**Set of entities: GALAXIES**Description: set of galaxies observed by teachers and students during observations, an entry is added when the whole observation about particular galaxy ended up successfully and reports and measurements about it are made, and might be deleted when information about particular galaxy are invalid; ~200 entries

Attribute name: galaxy\_nameMain key: NO Description: the name of each galaxy, max 50 signs, letters, numbers, whitespace characters and other special characters can be used

Attribute name: TypeMain key: NODescription: the Type of each galaxy chosen from: 'spiral', 'elliptical', 'peculiar', and 'irregular', so max 9 letters allowed

Attribute name: brightnessMain key: NODescription: brightness of each galaxy in magnitudo, max 7 signs, only numbers and '.' sign are allowed

**Set of entities: CONSTELLATIONS**Description: set of constellations observed by teachers and students during observations, an entry is added when the whole observation about particular constellation ended up successfully and reports and measurements about it are made, and might be deleted when information about particular constellation are invalid; ~200 entries

Attribute name: constellation\_nameMain key: NODescription: the name of each constellation, max 50 signs, letters, whitespace characters and other special characters can be used

Attribute name: brightest\_starMain key: NODescription: the brightest star of each constellation, max 50 signs, letters, whitespace characters and other special characters can be used

Attribute name: number\_of\_starsMain key: NO Description: number of stars that are part of particular constellation, max 10000 signs, only digits allowed, the number must be positive

Attribute name: abbreviationMain key: NO Description: abbreviation of the name of the constellation, max 10 signs, only letters allowed

**Set of entities: STARS**Description: set of stars observed by teachers and students during observations, an entry is added when the whole observation about particular star ended up successfully and reports and measurements about it are made, and might be deleted when information about particular star are invalid; ~200 entries

Attribute name: star\_nameMain key: NO Description: the name of each star, max 50 signs, letters, whitespace characters and other special characters can be used

Attribute name: temperatureMain key: NO Description: the measure of temperature in degrees Celsius, 5 digits are allowed from the range 0-20000

**Set of entities: PLANETS**Description: set of planets observed by teachers and students during observations, an entry is added when the whole observation about particular planet ended up successfully and reports and measurements about it are made, and might be deleted when information about particular planet are invalid; ~200 entries

Attribute name: planet\_nameMain key: NODescription: the name of each planet, max 50 signs, letters, whitespace characters and other special characters can be used

Attribute name: TypeMain key: NODescription: the Type of each planet based on chemical composition chosen from: 'Chthonian planet', 'Carbon planet', 'Coreless planet', 'Desert planet', 'Gas dwarf', 'Gas giant', 'Helium planet', 'Hycean planet', 'Ice giant', 'Ice planet', 'Iron planet', 'Lava planet', 'Ocean planet', 'Protoplanet', 'Puffy planet', 'Silicate planet', 'Terrestrial planet', so only letters and whitespace characters are allowed.

**Set of entities: MOONS**Description: set of moons observed by teachers and students during observations, an entry is added when the whole observation about particular moon ended up successfully and reports and measurements about it are made, and might be deleted when information about particular moon are invalid; ~200 entries

Attribute name: nameMain key: NODescription: the name of each moon, max 50 signs, letters, whitespace characters and other special characters can be used

Attribute name: explorerMain key: NODescription: the name and surname of the explorer of particular moon, only letters and whitespace characters are allowed, max 100 signs, letters before the space represent the name, letters after space represent surname

Attribute name: date\_of\_discoveryMain key: NODescription: date of discovery of the particular moon, consist of 10 signs(8 digits and 2 '.' signs), the first two digits represent the day of the month, are separated by '.' sign from the next two digits, which represent the month, which are separated by '.' sign from 4 digits, which represent the year, only future dates are not allowed

**Set of entities: OBSERVATIONS**Description: set of current and past observations made, an entry is added when the new observation starts, and might be deleted when the particular observation is proved to be invalid; ~1000 entries

Attribute name: observation\_IDMain key: YESDescription: enables to identify each observation, 4 digits number, the numbers to the observations are assigned in the order the observations were added starting from 0001 counting upward

Attribute name: date\_of\_observationMain key: NODescription: real date of each observation, consist of 10 signs(8 digits and 2 '.' signs), the first two digits represent the day of the month, are separated by '.' sign from the next two digits, which represent the month, which are separated by '.' sign from 4 digits, which represent the year

Attribute name: starting\_hour\_of\_observationMain key: NODescription: the hour when the real observation had started, 5 signs are allowed, 2 digits which represent the hour(can be chosen from range 00-23), separated by ':' sign from the next two signs which represent the minutes(can be chosen from range 00-59)

Attribute name: statusMain key: NODescription: status of each observation, can be chosen from: 'completed', 'in progress' and 'not started', so max 11 signs are needed including letters and white space

Attribute name: time-consumptionMain key: NODescription: the counted number of man-hours, max 4 digits number

**Set of entities: PLANETOIDS**Description: set of planetoids observed by teachers and students during observations, an entry is added when the whole observation about particular planetoid ended up successfully and reports and measurements about it are made, and might be deleted when information about particular planetoid are invalid; ~200 entries

Attribute name: planetoid\_numberMain key: NODescription: the assigned to particular planetoid, which is connected with the order of discovery, only digits allowed, max 7 digits

Attribute name: explorerMain key: NODescription: the name and surname of the explorer of particular planetoid, only letters and whitespace characters are allowed, max 100 signs, letters before the space represent the name, letters after space represent surname

Attribute name: date\_of\_discoveryMain key: NODescription: date of discovery of the particular planetoid, consist of 10 signs(8 digits and 2 '.' signs), the first two digits represent the day of the month, are separated by '.' sign from the next two digits, which represent the month, which are separated by '.' sign from 4 digits, which represent the year, only future dates are not allowed

Attribute name: nameMain key: NODescription: the name of each planetoid, max 50 signs, letters, whitespace characters and other special characters can be used

**Set of entities: EQUIPMENTS**Description: set of current and past equipment used in observations, an entry is added when the new equipment for observation is needed, and might be deleted when the particular equipment is no longer in usage; ~100 entries

Attribute name: equipment\_IDMain key: YESDescription: enables to identify each equipment, 4 digits number, the numbers to the equipment are assigned in the order the equipment were added starting from 0001 counting upward

Attribute name: nameMain key: NODescription: name of the equipment used, max 100 signs can be entered, including letters, digits, whitespace characters and other special characters

Attribute name: date\_of\_productionMain key: NODescription: date of production of each equipment, consists of 4 digits, which represents the date of production, future dates are not allowed

Attribute name: massMain key: NODescription: mass of each equipment, consist of max 4 digits, which represents the mass in kilograms of the particular equipment

**Set of entities: MEASUREMENTS**Description: set of measurements used to describe observed object, an entry is added after the new observed object is added and observations about its measurements are made ,and might be deleted when the measurements are wrong or the whole observation turns up to be invalid ; ~1000 entries

Attribute name: measurement\_IDMain key: YESDescription: enables to identify each measurement, 4 digits number, the numbers to measurements are assigned in the order the measurement were added starting from 0001 counting upward

Attribute name: distanceMain key: NODescription: distance of particular observed object from the Earth, max 50 signs can be entered, including letters, digits, and other special characters, it consist of number(which can contain '.' inside), space and chosen unit(letters)

Attribute name: radiusMain key: NODescription: radius of particular observed object, max 50 signs can be entered, including letters, digits, and other special characters, it consist of number(which can contain '.' inside), space and chosen unit(letters)

Attribute name: massMain key: NO Description: mass of particular observed object, max 50 signs can be entered, including letters, digits, and other special characters, it consist of number(which can contain '.' inside), space and chosen unit(letters)

Attribute name: volumeMain key: NODescription: volume of particular observed object, max 50 signs can be entered, including letters, digits, and other special characters, it consist of number(which can contain '.' inside), space and chosen unit(letters)

Attribute name: densityMain key: NO Description: density of particular observed object, max 50 signs can be entered, including letters, digits, and other special characters, it consist of number(which can contain '.' inside), space and chosen unit(letters)

Attribute name: average\_orbital\_speedMain key: NODescription: average orbital speed of particular observed object, max 50 signs can be entered, including letters, digits, and other special characters, it consist of number(which can contain '.' inside), space and chosen unit(letters)

Attribute name: areaMain key: NO Description: area of particular observed object, max 50 signs can be entered, including letters, digits, and other special characters, it consist of number(which can contain '.' inside), space and chosen unit(letters)

**Set of entities: ATMOSPHERIC\_CONDITIONS**Description: set of current and past atmospheric conditions occurred during observations, an entry is added when the new observation starts, and might be deleted when the observation is proved to be invalid; ~1000 entries

Attribute name: atmospheric\_condition\_IDMain key: YESDescription: enables to indentify each atmospheric condition, 4 digits number, the numbers to the atmospheric\_conditions are assigned in the order the observations were added starting from 0001 counting upward

Attribute name: cloudinessMain key: NODescription: the amount of clouds that occurs during particular observation, max 6 letters allowed, can be chosen from: 'small', 'medium', 'full'

Attribute name: breezinessMain key: NODescription: the measure of breeziness that occurs during observations, max 6 letters allowed, can be chosen from: 'small', 'medium', 'strong'

Attribute name: air\_humidityMain key: NODescription: the measure of air humidity that occurs during observations, max 6 letters allowed, can be chosen from: 'small', 'medium', 'big'

Attribute name: foggingMain key: NODescription: the measure of air fogging that occurs during observations, max 6 letters allowed, can be chosen from: 'small', 'medium', 'big'

Attribute name: temperatureMain key: NO Description: the measure of temperature in degrees Celsius, 3 signs are allowed, the first sign can be chosen from: '+', '-', the other 2 signs are digits from the range 0-40

Attribute name: visibilityMain key: NODescription: the measure of visibility that occurs during particular observation, max 6 letters allowed, can be chosen from: 'small', 'medium', 'good'

**Set of entities: PLANS**Description: set of current and past plans about observations which were made, an entry is added when the new plan is made (it is possible when the new observation is added), and might be deleted when the report is written (status of report changed to completed), so the observation is over and the plan is no longer needed; ~200 entries

Attribute name: plan\_IDMain key: YESDescription: enables to identify each plan, 4 digits number, the numbers to the plans are assigned in the order the plans were added starting from 0001 counting upward

Attribute name: planned\_date\_of\_observationMain key: NO Description: planned date of each observation, each consist of 10 signs(8 digits and 2 '.' signs), the first two digits represent the day of the month, are separated by '.' sign from the next to digits, which represent the month, which are separated by '.' sign from 4 digits, which represent the year. Past dates are not allowed

Attribute name: goalMain key: NO Description: assigned to each observation based on the main purpose that wants to be achieved, max 200 signs can be entered, including letters, digits, whitespace characters and other special

Attribute name: planned\_time-consumptionMain key: NODescription: the counted number of man-hours that the observation is planned to YESe, max 4 digits number

Attribute name: deadlineMain key: NODescription: the deadline of each observation, each consist of 10 signs(8 digits and 2 '.' signs), the first two digits represent the day of the month, are separated by '.' sign from the next to digits, which represent the month, which are separated by '.' sign from 4 digits, which represent the year. Past dates are not allowed

**Set of entities: OBSERVED\_OBJECTS**Description: set of current and past observed objects by teachers and students, an entry is added when the new observation is planned for a particular object in space, and might be deleted when the particular observation is invalid or cancelled; ~1000 entries

Attribute name: object\_IDMain key: YESDescription: enables to identify each object, 4 digits number, the numbers to the objects are assigned in the order the objects were added starting from 0001 counting upwards

Attribute name: latitudeMain key: NODescription: used to describe position in astronomy, x coordinate in a space, consists of numbers and other special characters. There are 3 digits, which are separated by '.' from the next digit and at the end there is '°' sign

Attribute name: longitudeMain key: NODescription: used to describe position in astronomy, y coordinate in a space, consists of numbers and other special characters. There are 3 digits, which are separated by '.' from the next digit and at the end there is '°' sign

**Description of relationships:**

Name relationship: end withEntity 1: OBSERVATIONSEntity 2: REPORTSType relationship: 1..n : 0..1Description of relationship: Represents with what end up observations done by teachers or students. Each Observation should have one report by default, but there are situations, when the observation could have no report, for example when observation is just added and the report is not written yet. Each Report can be written about one or many observations.

Name relationship: are made byEntity 1: OBSERVATIONSEntity 2: PERSONSType relationship: 0..n : 1..nDescription of relationship: Represents by whom observations are made. Each Person can conduct one or many observations, or no observations at all, especially when the student or teacher is new at the university. Each Observation can be made by one or more people.

Name relationship: are planned byEntity 1: OBSERVATIONSEntity 2: PLANSType relationship: 1..n : 0..1Description of relationship: Represents by what thing observations are planned. Each Observation should have 1 plan, but there are situations when no plans are made, for example when observation is done spontaneously. Each Plan can be about one or more observations.

Name relationship: needEntity 1: OBSERVATIONSEntity 2: EQUIPMENTSType relationship: 1..n : 1..nDescription of relationship: Represents what observations need to be made. Each Observation might have one more equipment needed. Each Equipment can be used in one or more observations.

Name relationship: are underEntity 1: ATMOSPHERIC\_CONDITIONSEntity 2: OBSERVATIONSType relationship: 0..1 : 1..nDescription of relationship: Represents under what thing observations are made. Each observation can have one, specified atmospheric conditions, with exception when somebody did not noticed every factor of atmospheric conditions. Each Atmospheric conditions might be checked during one or many observations, because many observation can be conducted at the same time with the same atmospheric conditions

Name relationship: are aboutEntity 1: OBSERVATIONSEntity 2: OBSERVED\_OBJECTSType relationship: 1..n : 1Description of relationship: Represents about what thing observations are made. Each Observation must be about one, specified object. About each Observed object can be made one or more observations.

Name relationship: are measured forEntity 1: MEASUREMENTSEntity 2: OBSERVED\_OBJECTSType relationship: 0..1 : 1Description of relationship: Represents for what thing measurements are measured. Each Measurement must have one particular object about which measurements are done about. Each Observed Object might have one or none measurements, when observation is made but measurement are not calculated yet or it is impossible to calculate that measurements for a particular observation. In case of many observations done about particular objects measurements can be corrected, but other measurements cannot be added, because for example it is one proper radius of some object etc.

Name relationship: IS\_AEntity 1: CONSTELLATIONSEntity 2: OBSERVED\_OBJECTSType relationship: 0..1 : 1Description of relationship: Represents a constellation, which is an observed object. Each Constellation can be one observed object. Each Observed object might be a constellation or might be not because also other objects than constellations can be observed.

Name relationship: IS\_AEntity 1: STARSEntity 2: OBSERVED\_OBJECTSType relationship: 0..1 : 1Description of relationship: Represents a star, which is an observed object. Each Star can be one observed object. Each Observed object might be a star or might be not because also other objects than stars can be observed.

Name relationship: IS\_AEntity 1: GALAXIESEntity 2: OBSERVED\_OBJECTSType relationship: 0..1 : 1Description of relationship: Represents a galaxy, which is an observed object. Each Galaxy can be one observed object. Each Observed object might be a galaxy or might be not because also other objects than galaxies can be observed.

Name relationship: IS\_AEntity 1: PLANETOIDSEntity 2: OBSERVED\_OBJECTSType relationship: 0..1 : 1Description of relationship: Represents a planet, which is an observed object. Each Planet can be one observed object. Each Observed object might be a planet or might be not because also other objects than planets can be observed.

Name relationship: IS\_AEntity 1: MOONSEntity 2: OBSERVED\_OBJECTSType relationship: 0..1 : 1Description of relationship: Represents a moon, which is an observed object. Each Moon can be one observed object. Each Observed object might be a moon or might be not because also other objects than moons can be observed.

Name relationship: IS\_AEntity 1: PLANETSEntity 2: OBSERVED\_OBJECTSType relationship: 0..1 : 1Description of relationship: Represents a planet, which is an observed object. Each Planet can be one observed object. Each Observed object might be a planet or might be not because also other objects than planets can be observed.

Name relationship: come underEntity 1: CONSTELLATIONSEntity 2: GALAXIESType relationship: 0..n : 1..nDescription of relationship: Represents about what thing constellations come under. Each Constellation can be a part of one or more galaxies, constellation without galaxy does not exist. Each Galaxy can be consist of none, one or many constellations.

Name relationship: are inEntity 1: PLANETSEntity 2: GALAXIESType relationship: 0..n : 1Description of relationship: Represents in what place are the planets. Each Planet belongs to one, particular galaxy. Each Galaxy can be consist of none, one or more planets.

Name relationship: are part ofEntity 1: PLANETOIDSEntity 2: GALAXIESType relationship: 0..n : 1Description of relationship: Represents what the planetoids are part of. Each Planetoid is a part of a one, particular galaxy. Each Galaxy can be consist of none, one or many planetoids.

Name relationship: belong toEntity 1: CONSTELLATIONSEntity 2: STARSType relationship: 0..n : 1..nDescription of relationship: Represents to what thing stars belong to. Each Star can belong to one or many constellations, or none constellation, because only a fraction of stars make up the shapes of constellations. Each Constellation must have many stars to be a constellation.

Name relationship: revolve aroundEntity 1: STARSEntity 2: PLANETSType relationship: 0..1 : 0..nDescription of relationship: Represents around what object planets revolve. Each Planet can revolve around one, particular planet or around none planet (rogue planets). Each Star is rounded by none, one or more planets.

Name relationship: circle aroundEntity 1: PLANETSEntity 2: MOONSType relationship: 1 : 0..nDescription of relationship: Represents around what object moons circle. Each Moon circle around one, particular planet. Each Planet can be rounded by none, one or many moons.

**4. Relational database schema**

1.Reports(report\_code, topic, start\_date, deadline, status, time-consumption, result)

2.Plans(plan\_ID, planned\_date\_of\_observation, goal, planned\_time-consumption, deadline)

3.Equipments(equipment\_ID, name, date\_of\_production, mass)

4.Persons(person\_ID, name, surname, date\_of\_birth, email\_adress, phone\_number, gender, type)

5.Observations(report\_code REF Reports, plan\_ID REF Plans, atmospheric\_condition\_ID REF Atmospheric\_conditions, object\_ID REF Observed\_objects, observation\_ID, date\_of\_observation, starting\_hour\_of\_observations, time-consumption, status)

6.Atmospheric\_conditions(atmospheric\_condition\_ID, cloudiness, breeziness, air\_humidity, fogging, temperature, visibility)

7.Constellations(object\_ID REF Observed\_objects, object\_ID, constellation\_name, brightest\_star, number\_of\_stars, abbreviation)

8.Observed\_objects(object\_ID, latitude, longitude)

9.Measurements(object\_ID REF Observed\_objects, measurement\_ID, distance, radius, mass, volume, density, average\_orbital\_speed, area)

10.Stars(object\_ID REF Observed\_objects, object\_ID, star\_name, temperature)

11.Galaxies(object\_ID REF Observed\_objects, object\_ID, galaxy\_name, type, brightness)

12.Planetoids(object\_ID REF Observed\_objects, object\_ID REF Galaxies, object\_ID, planetoid\_number, explorer, date\_of\_discovery)

13.Planets(object\_ID REF Observed\_objects, object\_ID REF Stars, object\_ID REF Galaxies, object\_ID, planet\_name, type)

14.Moons(object\_ID REF Observed\_objects, object\_ID REF Planets, object\_ID, name, explorer, date\_of\_discovery)

15.Need(Equipment REF Equipments, Observation REF Observations)

16.Coming\_under(Constellation REF Constellations, Galaxy REF Galaxies)

17.Belonging(Constellation REF Constellations, Star REF Stars)

18.Made\_by(Person REF Persons, Observation REF Observations)