Intro to the Nature of Science Lab

*This lab is to be completed in groups of 2-3 people. You should answer all of the questions on a separate sheet of paper and should hand in just one paper per group with all group members' names on it. Each group member should participate equally in the lab. All group members should complete the readings when the lab prompts them to do so. Group members who finish the readings before others should sit quietly and wait for everyone to finish. **Do not pick up the second two articles until the lab prompts you to!**

Purpose: To introduce the concept of pseudoscience and to begin to identify qualities that distinguish it from true science.

Materials: Three readings:
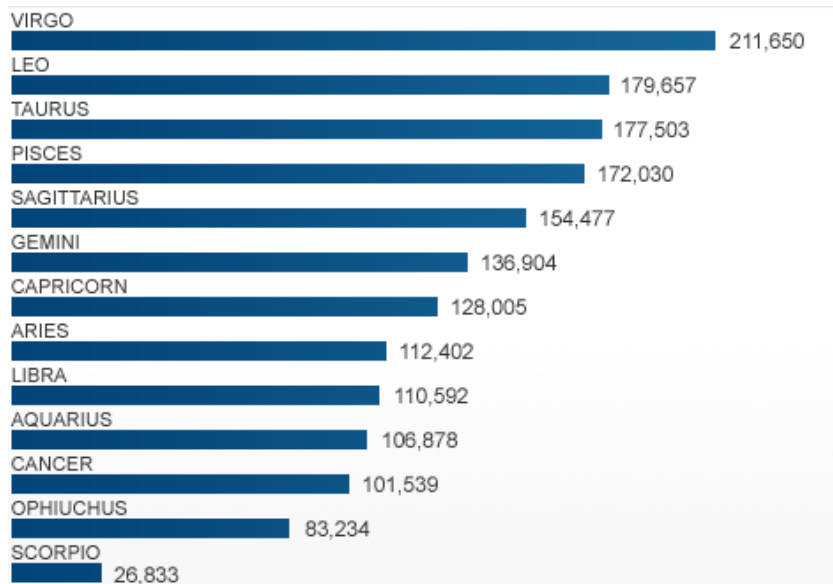   (1) "Horoscope Hang-Up: Earth Rotation Changes Zodiac Signs"
        (2) "The Astrotest"
        (3) "An Astronomer Looks at Astrology"

Instructions

In 2011, the "New" Zodiac Signs were rolled out in the media. Read the brief article from Time magazine online entitled "Horoscope Hang-Up: Earth Rotation Changes Zodiac Signs", then answer questions 1-4 <u>on a separate sheet of paper</u>.

1. The article describes a reason that astronomers defined a new set of Zodiac signs. What was their reasoning for this?
2. What is the scientific explanation for this phenomenon (the signs being off by ~one month) according to this article?
3. Is this a good, scientific article? Why or why not? Are you satisfied by the explanations it provides?
4. Write down two questions you have about the subject that are not answered by this article.

Shortly after the release of these "New" Zodiac signs, Allstate Insurance Company issued a press release that correlated drivers' Zodiac signs with their likelihood of crashing. The article listed the number of crashes in Allstate's 2010 records in which drivers of each Zodiac sign (note that they include Ophiuchus!) were involved, and the data are represented on the next page in graphical form. Answer the questions that follow on a separate sheet of paper.

VIRGO	211,650
LEO	179,657
TAURUS	177,503
PISCES	172,030
SAGITTARIUS	154,477
GEMINI	136,904
CAPRICORN	128,005
ARIES	112,402
LIBRA	110,592
AQUARIUS	106,878
CANCER	101,539
OPHIUCHUS	83,234
SCORPIO	26,833

5. What does the chart imply? Summarize its meaning in one sentence.
6. What is your first reaction to this data? Are you surprised? Do you have any doubts about its validity?

Examine the table of information below, which shows the same crash information, plus two additional pieces to the puzzle: the birthdates and personality characteristics that correspond to each sign.

Sign	Birthdates	Personality Characteristics	Number of Drivers Involved in Accidents in 2010
Scorpio	Nov 23- Nov 28	Passionate, resourceful	26,833
Ophiuchus	Nov 29 – Dec 17	Wise, ambitious, lucky	83,234
Cancer	July 21 – Aug 9	Compassion, sensitivity	101,539
Aquarius	Feb 16 – March 11	Progressive, independent	106,878
Libra	Oct 31 – Nov 22	Cooperative, gracious	110,592
Aries	Apr 17 – May 13	Impatient, determined	112,402
Capricorn	Jan 18 – Feb 15	Responsible, disciplined	128,005
Gemini	June 20 – July 20	Short attention span, nervous	136,904
Sagittarius	Dec 18 – Jan 17	Impatient, idealistic	154,477
Pisces	March 12 – April 16	Fearful, overly trusting	172,030
Taurus	May 14 – June 19	Uncompromising, possessive	177,503
Leo	Aug 10 – Sept 15	Arrogant, inflexible	179,657
Virgo	Sept 16 – Oct 30	Worried, shy	211,650

7. Explain why the personality characteristics associated with each sign can't explain the car crash data **using specific examples from the table above**.
8. Do the birthdates explain the crash data? Why or why not?
9. If you were to add one column to the table above that would explain why zodiac sign is correlated with car crashes, what would it be? Add it to the table on the previous page and fill it in.

Now, lets examine the basic premise of Astrology itself: that your personality, fate or the quality of your day might be determined by the position of the sun and planets on the date of your birth.

10. Is this idea testable? Together with your group mates, design a test that YOU could conduct to investigate whether horoscope predictions are valid and describe it.

Pick up and read the article "The Astrotest", which is about one such scientific experiment to test the validity of Astrologers' predictions, and then answer questions 9-11 on a separate sheet of paper.

11. In one paragraph, describe the "Astrotest" experiment conducted by the author. What was his hypothesis and how did he test it? Describe the experimental design and its results
12. Is this a good, scientific article? If so, name a couple of differences you see between this article and the first one you read that makes this article more scientific (or, if you disagree, name a couple of similarities).
13. Together with your group mates, brainstorm two tough questions that you might ask an astrologer if you were given an opportunity to interview one and "feel them out" regarding how legit their profession is.

Pick up and read the article 'An Astronomer Looks at Astrology", which asks 10 such questions, and then answer questions 12-14 below.

14. How were these questions similar or different to the two you came up with?
15. In what way is Mr. Fraknoi's approach to the topic scientific?
16. How do the "sidebars" included in the article (in grey) help to strengthen it's argument?

17. Together with your group mates, brainstorm some qualities of science that distinguish it from fake or "pseudo" science and list them (bullet/list form is fine). Also, make a similar list to describe the qualities of Pseudoscience. You may wish to take notes in the space provided below as you will be asked to do something similar for your first homework assignment. However, when you complete it for homework, make sure to put these qualities in your own words and not those of your group members!

Characteristics of Good Science   Characteristics of Pseudoscience

18. **Each group member should answer this question separately**.
    Finally, has this exercise changed your mind about the validity of Astrology at
    all? (Be honest – I won't judge!) Why or why not?