MATH 1030-005, Exam 1 Solution **Fall 2012**

1. **(15 pts)** Determine whether the following arguments are deductive or inductive. If they are deductive determine whether the argument is valid or not by using a Venn-diagram test, and whether or not it is sound. If the argument is inductive, state whether the argument is strong or weak with an explanation.

   (a) Premise: All basketballs are round.
   Premise: The Earth is round.
   Conclusion: The Earth is a basketball.

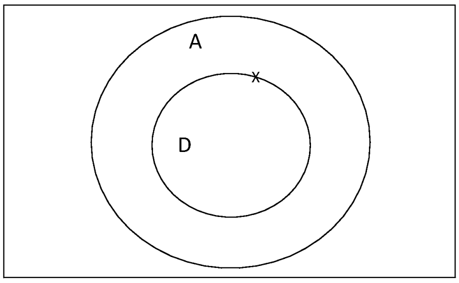

Figure 1: This is a deductive argument. Here D represents the set of all basketballs, A the set of all things that are round, while X represents the Earth. The second premise tells us that the Earth is round, which means that X needs to be placed inside set A, but it says nothing about set D, so we place X on the border of this set. However, the conclusion tells us that X should be *inside* set D, which means that this argument is invalid, and therefore unsound.

   (b) Premise: If Linda becomes the class president, the lunch will cost $1 less.
   Premise: Linda did not become the class president.
   Conclusion: The lunch does not cost $1 less.

   This is an *if p than q* **denying the hypothesis** deductive argument, which is always invalid, and therefore unsound.

   (c) Premise: Nobody ever saw a white crow.
   Conclusion: A white crow does not exist.

   This is an inductive argument. It is strong, in my opinion, because it is highly unlikely that a white crow exists if not one person ever saw it.

2. **(7 pts)** Use braces to write the members of a set of all integers between -8.8 and 34.01. *(Dots may be helpful.)*

$$\{-8, -7, -6, ..., 34\}$$

3. The distance between the Earth and the Moon is approximately $400,000$ kilometers. The Earth's diameter is close to $13,000$ kilometers, while the Moon's is about $3,500$ kilometers.

   (a) **(7 pts)** Write those three numbers in scientific form (notation).

$$4 \times 10^5, \;\; 1.3 \times 10^4, \;\; 3.5 \times 10^3.$$

   (b) **(7 pts)** How many times is the Earth's diameter bigger than the Moon's.

$$\frac{1.3 \times 10^4}{3.5 \times 10^3} = 3.714.$$

4. **(7 pts)** How long, in years, would it take you to count \$1 billion in \$100 bills, assuming you can count one bill each second?

$$\$10^9 \times \frac{1\,bill}{\$100} \times \frac{1\,s}{1\,bill} \times \frac{1\,min}{60\,s} \times \frac{1\,hr}{60\,min} \times \frac{1\,day}{24\,hr} \times \frac{1\,year}{365\,day} = 0.317\,years.$$

5. **(7 pts)** The number of traffic accidents in some large city dropped from 155,501 in 2007 to 124,600 in 2012. Find the absolute and relative (percentage) change.

$$absolute\ change = 124,600 - 155,501 = -30,901.$$

$$relative\ change = \frac{-30,901}{155,501} = -19.87\%.$$

6. **(7 pts)** There are approximately 2.7 million weddings in the U.S. every year. How many is this every second?

$$\frac{2.7\times 10^6\,weddings}{1\,year}\times\frac{1\,year}{365\,day}\times\frac{1\,day}{24\,hr}\times\frac{1\,hr}{60\,min}\times\frac{1\,min}{60\,s}=\frac{0.086\,weddings}{second}.$$

7. A swimming pool is 125 feet long, 95 feet wide, and 3.2 yards deep.

   (a) **(7 pts)** What is the volume of the pool in cubic feet? *(1 yd = 3 ft)*

$$V = 125\,ft\times 95\,ft\times 3.2\,yd\times\frac{3\,ft}{1\,yd}=114,000\,ft^3.$$

   (b) **(7 pts)** What is its volume in cubic meters? *(1 m = 3.28 ft)*

$$(1\,m)^3=(3.28\,ft)^3\Rightarrow 1\,m^3=35.3\,ft^3.$$

$$114,000\,ft^3\times\frac{1\,m^3}{35.3\,ft^3}=3,230.6\,m^3.$$

8. In track and field, Aries Merritt is the world record holder in a 110 meters hurdles race, with the result of 12.80 seconds. What is his average speed in

   (a) **(7 pts)** meters per second.

$$v = \frac{110\,m}{12.8\,s} = 8.6\,m/s.$$

   (b) **(7 pts)** kilometers per hour. *(1 km = 1000 m.)*

$$\frac{8.6\,m}{1\,s} \times \frac{60\,s}{1\,min} \times \frac{60\,min}{1\,hr} \times \frac{1\,km}{1000\,m} = 31\,km/hr.$$

   (c) **(7 pts)** miles per hour. *(1 mi = 1.61 km.)*

$$\frac{31\,km}{1\,hr} \times \frac{1\,mi}{1.61\,km} = 19.25\,mi/hr.$$

9. **(7 pts)** Find the scale ratio of a city map if 1 inch on the map equals 2 miles on Earth. *(1 mi = 5,280 ft)*

$$2\,mi \times \frac{5,280\,ft}{1\,mi} \times \frac{12\,in}{1\,ft} = 126,720\,in.$$

   So the scale ratio is $1 : 126,720$.