1) (4 pts) Consider the following argument:
   • Mark is taller than Tom.
   • Rick is taller than Tom.
   Therefore:
   • Rick is taller than Mark.

   a) Assign the heights 5, 6, or 7 (fill in the boxes) to the three gentlemen so that the premisses
      of the argument are true, and the conclusion is true. 
      
      | M | T | R |
      |---|---|---|
      | 6 | 5 | 7 |

   b) Assign the heights 5, 6, or 7 (fill in the boxes) to the three gentlemen so that the premisses
      of the argument are true, but the conclusion is false. 
      
      | M | T | R |
      |---|---|---|
      | 7 | 5 | 6 |

   c) Is the above argument deductive? Explain in one sentence.

   SOLUTION: No, because, as part b) shows, the conclusion may be false even if the premises
   are true.

2) (4 pts) a) Is the following is a deductive argument? Explain.
   • All US presidents were men.
   • G. Washington was a man.
   Therefore:
   • G. Washington was a US president.

   SOLUTION: No, because there are/were men who were not US presidents.

   b) Give an example of a deductive argument.

   SOLUTION:
   • A student who misses more than 10 lectures of ART 101 fails the class.
   • Nick missed more than 10 lectures of ART 101.
   Therefore:
   • Nick failed ART 101.

   FYI, and for the last time, the conclusion in the deductive argument contains just a part
   of the information already contained in the premises, and is therefore automatically true if
   the premises are true. For example, the conclusion that Nick failed ART 101, contains less
information than what is contained in the premises: Nick failed because he missed 10 lectures, and not just Nick, any other student who missed 10 lecture.

Finally, I made up the story, so it is pointless to discuss whether the premises or the conclusion are true or false. However, if there was ever a class named ART 101 which had that particular rule, and there was a student in that class named Nick who missed more than lectures then he surely failed the class.

3) (4 pts) A warehouse is 40 yards long and 25 yards wide.
   a) What is the area of the warehouse in square feet? (1 yd = 3 ft)
   b) Assuming that 1 ft = 30 cm, what is the area of the warehouse in square meters?

SOLUTION: Since 1 \(yd^2 = 9 ft^2\), the area of the warehouse in square feet is

\[40yd \times 25yd = 1000yd^2 = 9000 ft^2.\]

Since 1 ft = 30 cm = 0.3 m, after squaring, 1 ft\(^2 = 0.09 m^2\). Thus

\[9000 ft^2 = 9000 \times 0.09 m^2 = 810 m^2.\]

4) (4 pts) Use the conversion formula \(C = \frac{5}{9}(F - 32)\) to convert 20\(^\circ\)C and 40\(^\circ\)C into Fahrenheit.

SOLUTION: 20 = \(\frac{5}{9}(F - 32)\) implies 20 \(\times \frac{9}{5} = F - 32\). The left hand side is 36, so adding 32 to both sides gives \(F = 68\). Similarly, \(C = 40\) translates into \(F = 104\).

5) (4 pts) In our class we estimated that if you put one grain of rice on the first field of the chessboard, then 2, 4, 8 etc on the following fields (double the amount on each field), then the total amount of rice is an astonishing 800 billion metric tons of rice.
   a) Assuming that the state of Utah is a rectangle with a base of 200 km and a height of 500 km, compute the area of Utah in square meters. Express the answer as power of 10.
   b) If we pour 800 billion of tons over the area of the size of Utah, how many tons of rice do we get per square meter? If one ton of rice takes 2 cubic meters, how high, on average, is the pile of rice?

SOLUTION: Since 1 \(km = 10^3 m\), after squaring, \(1 km^2 = 10^6 m^2\). Thus the area of Utah is

\[500 km \times 200 km = 100,000 km^2 = 10^5 km^2 = 10^{11} m^2.\]

800 billion of tons is \(8 \times 10^{11}\) tons. Thus you get 8 tons per square meter, and that stacks 16 meters high.

6) (5 pts) The price of tuition at private colleges increased from $15,000 in 1989 to $25,000 in 2008. On the other hand, the consumer price index (CPI) for 1989 and 2008 is 124 and 215.3, respectively.
   a) Calculate, in percentages, the relative increase in the tuition from 1989 to 2008.
   b) Calculate, in percentages, the relative increase of CPI from 1989 to 2008.
   c) Had the tuition followed CPI, would should have been the tuition in 2008?

SOLUTION:
a) The absolute increase is $10,000. The relative increase is \( \frac{10,000}{15,000} = 0.666 = 66.7\% \).

b) The absolute increase is 91.3. The relative increase is \( \frac{91.3}{124} = 0.736 = 73.6\% \).

c) Had the tuition followed CPI, it would have increased by 73.6\% (of $15,000 and this is $11,044) i.e. the tuition would be $26,044.

7) (5 pts) The first table gives free-throw percentages for Kory Brabant and Shanille O’quil for the first and the second half of a basketball game. Give a hypothetical scoring for each player in the form FTA/FTM (Attempts/Made) reflecting the percentages (for example 2/8 for Kory in first half) so that Simpson’s paradox holds: Kory’s percentage for the whole game should be better than Shanille’s percentage for the whole game. (Compute those percentages.)

<table>
<thead>
<tr>
<th></th>
<th>K</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>25%</td>
<td>40%</td>
</tr>
<tr>
<td>II</td>
<td>60%</td>
<td>80%</td>
</tr>
</tbody>
</table>

SOLUTION: Although Kory is worse than Shanille in each half, Kory’s second half percentage is better than Shanille’s first half percentage. Thus, if most of Kory’s free throws occurred in the second half, while most of Shanille’s free throws occurred in the first half, Kory’s overall percentage has a chance of being better. With this in mind, let’s try some numbers:

- The first half: Kory 1/4 and Shanille 8/20.
- The second half: Kory 12/20 and Shanille 4/5.

For the whole game Kory has 13/24 = 54\%, while Shanille 12/25 = 48\%.