Math 335
Assignment 5

Section 3.4 - 3.5

3.4 - Travels Toward the Stratosphere of Infinities

7. If the board members are numbered 1-8, the set of agenda items is the same as the set of board members: $\{1, 2, 3, 4, 5, 6, 7, 8\}$
   Since the chair can choose any of these items, he is choosing any subset - there are 2^8 subsets, so there are 256 possible agendas (if the chair is allowed to have an empty agenda - if he is not, there are 255 possibilities)

8. S contains @ and !
   $P(S)$ contains $\{!, @\}$ and $\{!, \#, \%\}$ and $\{\#\}$
   $P(P(S))$ contains $\{\{!\}, \{@\}, \{\#\}, \{\%\}, \{\&\}\}$ and $\{\{@\}, \{\$, !\}\}$
   $P(P(P(S)))$ contains $\{\{\{@, !\}\}, \{\{\$\}\}\}$ and $\{\{\{@\}\}, \{\{\#, \$\}\}, \{\{!\}, \{\%, \&\}\}\}$ and $\{\{\{!\}\}\}$

13. Cantor's proof says that a particular element not on the list (M_f) includes $\{x \mid x \in S \text{ and } x \notin f(x)\}$:
   ~~all ∈ f(all)~~ , you ∉ f(you) , ~~infinity ∈ f(infinity)~~ ,
   found ∉ f(found), ~~them ∈ f(them)~~ , ~~search ∈ f(search)~~ ,
   ~~the ∈ f(the)~~ , it ∉ f(it)
   * Element of P(Words) not on the list: {you, found, it}

29. * $2^5 2^{-3} 2^2 = 2^{(5-3+2)} = 2^4 \boxed{= 16}$

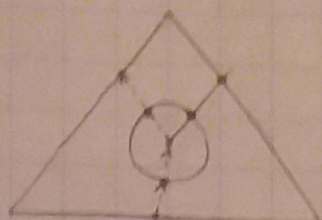
   * $\frac{2^x 2^y}{2^2} = 2^x 2^y 2^{-2} \boxed{= 2^{(x+y-2)}}$

   * $\frac{6^x}{2^x 3^x} = \frac{6^x}{(2 \times 3)^x} = \frac{6^x}{6^x} = 6^{(x-x)} = 6^0 \boxed{= 1}$

   * $\frac{2^t 3^t 5^t}{10^t} = \frac{(2 \times 5)^t 3^t}{10^t} = \frac{\cancel{10^t} 3^t}{\cancel{10^t}} \boxed{= 3^t}$

   * $\frac{5^3}{5^{-2} 25} = \frac{5^3 5^2}{25} = \frac{5^3 \cancel{5^2}}{\cancel{5^2}} = 5^3 \boxed{= 125}$

3.5 - Straightening Up the Circle

8. 

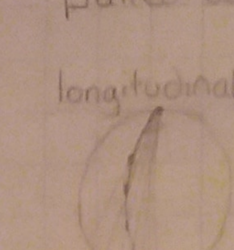
Any point on the circle can be connected to exactly one point on the triangle by drawing a straight line from some point inside the circle through the point on the circle to a point on the triangle. Conversely, any point on the triangle corresponds to the point on the circle that the line from the point on the triangle to the centre point passes through. Since exactly one point on the circle corresponds with exactly one point on the triangle (and vice versa), there is a 1-1 correspondence and the cardinality of points on the small circle is the same as the cardinality of points on the large triangle.

12. Using the failed perfect shuffling of digits, the point on the line (0.1200100100100 1...) would be paired with the point (0.101001001..., 0.200100100...).

* If this point is reshuffled using the failed shuffling again, it would correspond to the same point and there would be no problem, since neither x or y end in unending 0s.
* If this point is reshuffled using the successful shuffling method, it would correspond to the point 0.120100100 1... on the line. This is problematic, since the different methods of shuffling correspond to slightly different points (0.12001001... vs 0.1201001001...).

21.
- A circle drawn along the longitudinal lines would be paired with a line on the plane
- A circle drawn along the latitudinal lines would be paired with a circle on the plane

longitudinal:



latitudinal: