HW 11, HONR 209M. Morally DUE Tuesday May 5

Definition: Lets say that a country has 3 states which we call A, B, C and they have number-of-people a, b, c. Let $t = a + b + c$. Lets say the congress has d people in it. A *fractionally fair representation* would allocate $f_A = \frac{da}{t}$ reps to A, $f_B = \frac{db}{t}$ reps to B, $f_C = \frac{dc}{t}$ reps to C. While this is absolutely fair it involves states having a fractional number of representatives which does not work in practice. But it does give us a point of comparison to what really happens. Assume that we end up assigning integers r_A, r_B, r_C to A, B, C. A is HAPPY if $r_A > f_A$, SAD if $r_A < f_A$, and NEUTRAL if $r_A = f_A$. Similar for B, C.

End of Definition

Recall From Clydes Lecture: The way number-of-reps is allocated to states in the USA, the Huntington-Hill Method, works as follows. Initially all states get one representative. Let p be the population of a state and r be the current number of reps that it has. For each state calculate $w = \frac{p}{\sqrt{r(r+1)}}$. Whichever state has the highest such weight gets the next representative.

Convention for this hw: Use $w = \frac{p}{r}$ for this HW for ease of calculation. (Note: the answers you get using this convention might differ from the answers you would get from using the real formula, but this is a HW, not a serious political calculation that anyone will use.)

Second Convention: If the weights are tied then the state with the least pop gets the next rep.

1. When is the final? Where is the final? Are you ready for the final?

2. (80 points) The country of Trashcanastan has three states A, B, C. A has 10 people, B has 30 people, C has 40 people. For $d = 3, 4, 5, 6, 7, 8, 9$ do the following: (and put your answers in a nice table as I will do below.) (NOTE: The $d = 3$ case is just give every state one rep.)

    (a) Determine using the Huntington-Hill method how many representatives A, B, C get if there are d reps total.

    (b) Determine for A, B, C if they are HAPPY, SAD, or NEUTRAL.

    See next page for a table in the form we want.

d	f_A	r_A	A's mood	f_B	r_B	B's mood	f_C	r_C	C's mood
3									
4									
5									
6									
7									
8									
9									

3. (20 points) In your table the case of $d = 8$ should work out nicely as:

d	f_A	r_A	A's mood	f_B	r_B	B's mood	f_C	r_C	C's mood
8	1	1	NEUTRAL	3	3	NEUTRAL	4	4	NEUTRAL

This is because the total population is $10 + 30 + 40 = 80$ and 8 divides 80. In the last problem you used weights $\frac{p}{r}$ and the convention that in case of a tie the state with the least pop gets the next rep.

(a) If we had use the real weights formula, $\frac{p}{\sqrt{r(r+1)}}$, then who would get the next rep?

(b) (THINK ABOUT, DO NOT HAND IN.) We used the approximation $\frac{p}{r}$. The real formula is $\frac{p}{\sqrt{r(r+1)}}$. Which one is better for the lowest-population state?