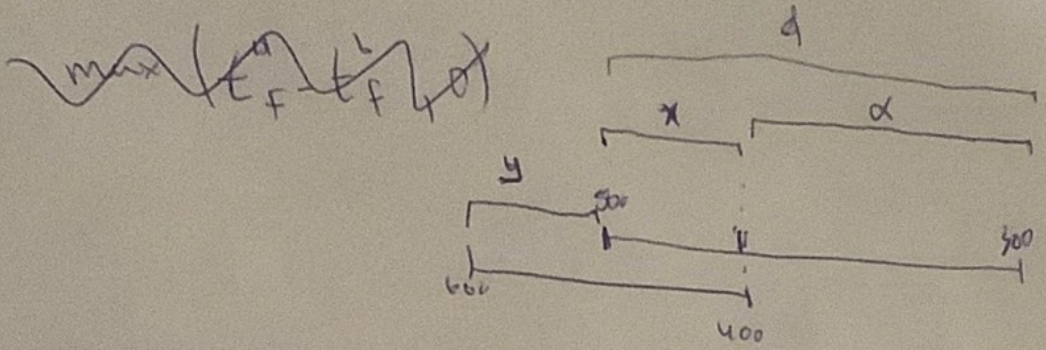
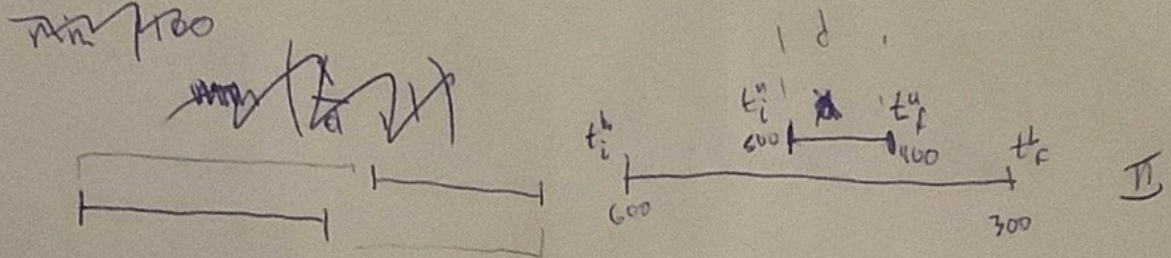
g/ all units in age range





$x =$

$x = d - \alpha - y$ $\quad f = \frac{x}{d}$ = weighting

$$\begin{bmatrix} y = \max(0,\ t_i^b - t_i^u) \\ \alpha = \max(0,\ t_f^u - t_f^b) \end{bmatrix}$$

but w/ convention of age increasing backwards, multiply ages by -1

$$\frac{x}{d} = \frac{d - \alpha - y}{d}$$

$$= \frac{d - \max(0,\ t_i^u - t_i^b) - \max(0,\ t_f^b - t_f^u)}{d}$$

I → f = ½ ✓

II → f = 1 ✓

$t_1 = t_i^b$

$t_2 = t_f^b$

$a = \max(0,\ t_i^u - t_i^b)$

$b = \max(0,\ t_f^b - t_f^u)$

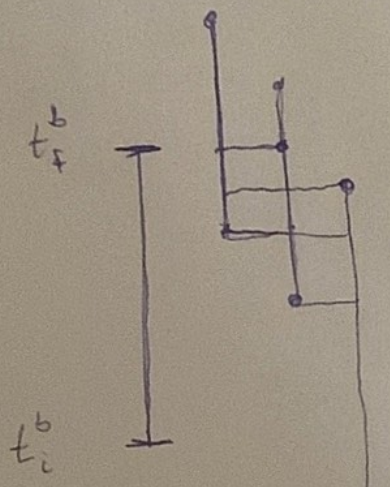
need algorithm to find overlapping segments of units within a column and within user-selected time bounds.

I

① weight all units by overlap with user-selected time bounds
→ units with no overlap in time bounds can just multiplied by zero.
→ need to get their indices ✓

② gather units by column, only consider units with non-zero weights ✓
→ need to elegantly work w/ .groupby( ) *

③ find all overlapping segments of units

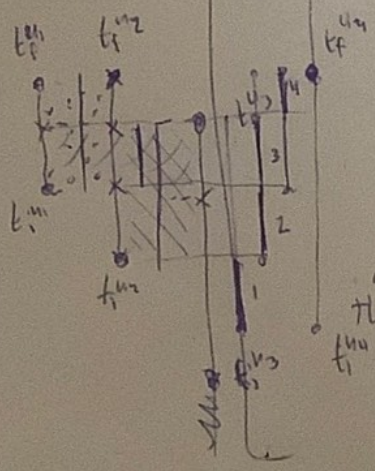


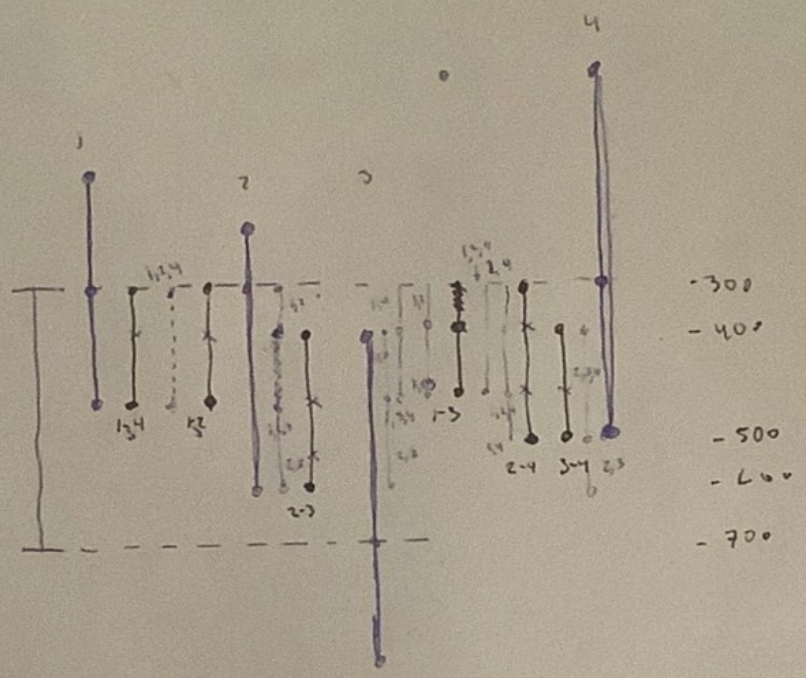
algorithm:
- truncate all unit segments into time bounds ✓

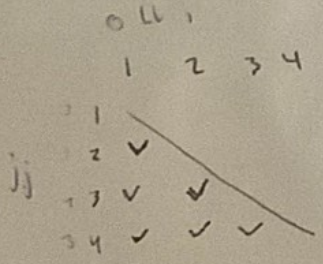
1) $t_f^{u_j} < t_f^b \rightarrow t_f^{u_j} = t_f^b \quad \forall_j$
$t_i^{u_j} > t_i^b \rightarrow t_i^{u_j} = t_i^b$

2) for each unit:
for each other unit (combinations):
if $[(t_i^{u_i} - t_f^{u_i}) \geq 0]$ And $[(t_i^{u_i} - t_f^{u_i}) \geq 0]$
overlap.append($[\max(t_f^{u_i}, t_f^{u_j}), \min(t_i^{u_i}, t_i^{u_j})]$
add overlapping segment
add segments that overlap
overlap units.append($[i, j]$)

seg1: $[t_f^{u_1}, t_i^{u_1}]$ 1,2
seg2: $[t_f^{u_2}, t_i^{u_2}]$ 2,3
seg3: $[t_f^{u_3}, t_i^{u_3}]$ 1,3



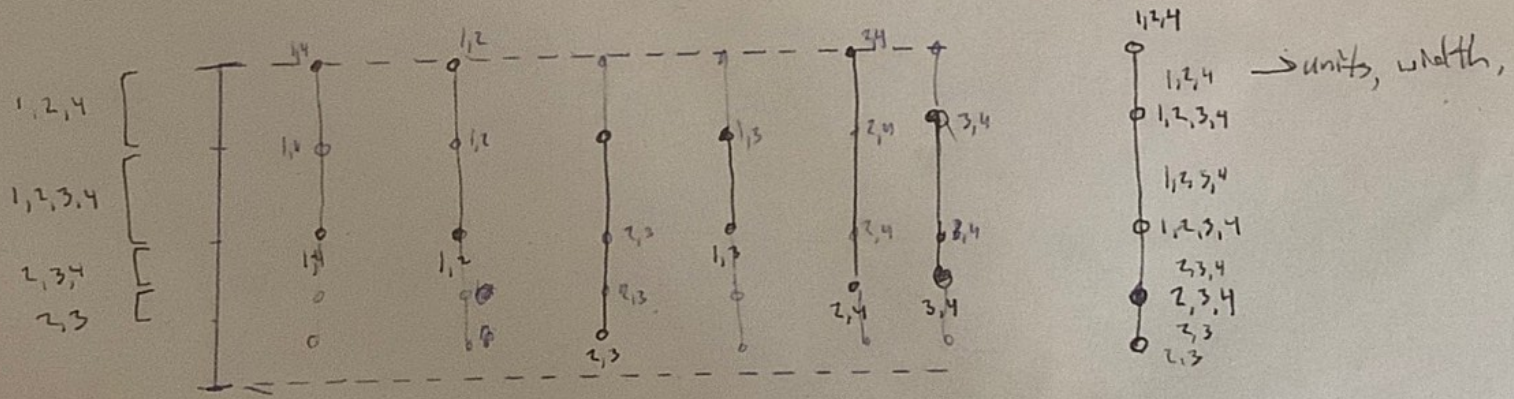




→ goal: how segments with overlapping unit ids

3) evaluate overlap on overlapping segments:

for each seg i:
  for each other seg j (combinations):
    if $(seg_i^i - seg_f^j) \geq 0$ AND $(seg_i^j - seg_f^i) \geq 0$:



~~for~~
1) get all coordinates (unique coords)
2) for each overlapping seg, ~~compute~~ add words

II

1) get all unique coords of overlapping segments
2) for each overlap segment, create a master segment with vertices between the nodes of the original segment having the overlapping unit indices
3) append all of the "master segments" (i.e. concatenate by vertices) and remove redundant unit indices.
4) segments between vertices have units overlapping that are the same between the two vertices

→ see bottom diagram on Fig 3

---

leaving identified segments where units overlap, use as correction to summed thicknesses of units in column & time interval.

first step

i.e. → add up thicknesses (as am currently doing). then evaluate overlap. if list of overlapping segments is non-zero in length, go to II.

II. if units overlap, for each time interval where they overlap
1) get all units that overlap.
2) take minimum sed rates to subtract to make a "max thick" correction
i.e. subtract $\sum_{i}^{n-1} \alpha_i \delta t$ where α_i are the n-1 slowest sed rates for the n units that overlap, leaving only the thickness for the thickest unit in the total thickness estimate.

"max thick" estimate: take the n-1 fastest sed rates