SYSC 3303: Iteration 0 Group 15
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Based on the times posted on Brightspace, we have computed the average time to move between two adjacent floors (4m) to be 9.5s (mean of provided times). We have also calculated the average mean time to move from the first floor to the top floor (7 * 4 = 28m) to be around 19.8s.

We decided to use the means as the values were relatively inconsistent overall - hence, there was no clear mode. The median would've been unrepresentative of the entire data set and the mean is reasonable as the averages of the extermas would allow them to effectively "cancel" out.

With the two average time measurements, we were able to derive various kinematic equations (work attached) which reduced to two equations with two unknowns. Solving for the acceleration yields $a = 0.4$ m/s^2 and a top speed of $at = 2.33$ m/s. These parameters yield a time of 19.8s to go from the bottom floor to the top and 7.3s to travel between adjacent floors. This is still reasonable considering that 7.3s is close to 9.5s and still above the minimum recorded value for adjacent floor traversal. We note that our solution does not allow the elevator to attain top speed when traveling between adjacent floors - rather, it accelerates for 2m and decelerates for the remaining 2m.

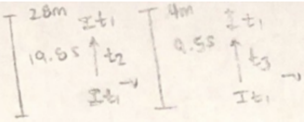
For the unloading time, we have used the average (un)loading time to be 7s assuming this is for a single individual. We'll assume that a single person (leaving or entering) accounts for 1s of this loading time, and there's a base of 6s for the doors to open and close. Hence, for loading time we're using

*loading_time = 6s + (number individuals entering + number individuals leaving) * 1s*

Summary:
Acceleration/Deceleration: 0.3 m/s^2
Top Speed: 2.33 m/s
Loading Time:
*loading_time = 6s + (number individuals entering + number individuals leaving) * 1s*

Rough work for kinematic analysis is provided on the following page.

Kinematic Rough Work:



$2t_1 + t_2 = 19.8$

$2t_1 + t_3 = 9.5$

$-v = at_1$

$d_1 = \frac{1}{2}at_1^2$

$d_2 = -vt_2$

$d_3 = -vt_3$

$2d_1 + d_2 = 28$

$2d_1 + d_3 = 4$

$at_1^2 + d_2 = 28$

$at_1^2 + -vt_2 = 28$

$at_1^2 + -v(19.8 - 2t_1) = 28$

$at_1^2 + 19.8at_1 - 2at_1^2 = 28$

$\boxed{0 = at_1^2 - 19.8at_1 + 28}$

$at_1^2 + d_3 = 4$

$at_1^2 + -vt_3 = 4$

$at_1^2 + v(9.5 - 2t_1) = 4$

$at_1^2 + 9.5at_1 - 2at_1^2 = 4$

$\boxed{0 = at_1^2 - 9.5at_1 + 4}$

$0 = a(t_1^2 - 19.8t_1) + 28$

$a = \frac{-28}{t_1^2 - 19.8t_1}$

$= \frac{-28}{t_1(t_1 - 19.8)}$

$0 = \frac{-28}{\cancel{t_1}(t_1 - 19.8)} t_1^{\cancel{2}} - \frac{9.5(-28)\cancel{t_1}}{\cancel{t_1}(t_1 - 19.8)} + 4$

$0 = \frac{-28}{t_1 - 19.8} t_1 + \frac{9.5(28)}{t_1 - 19.8} + 4$

$0 = -28t_1 + 266 + 4t_1 - 79.2$

$= -24t_1 + 186.8$

$\boxed{t_1 = 7.78\overline{3}}$ $\boxed{a = 0.29937}$