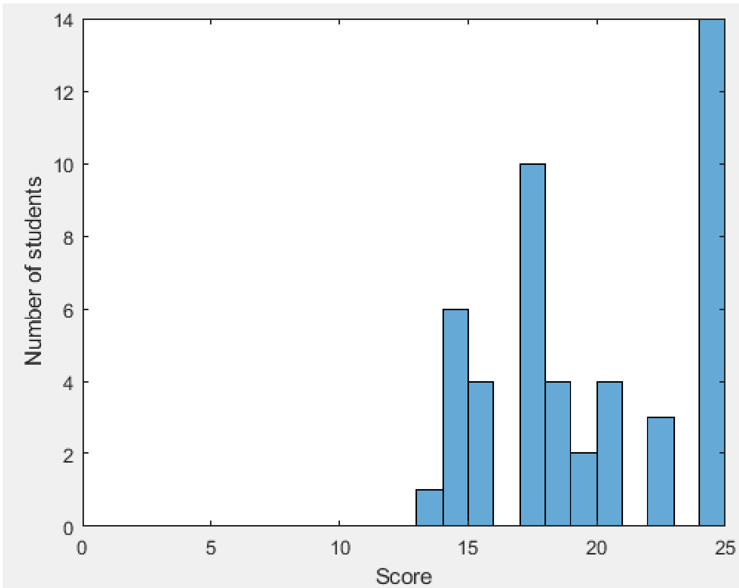
Prelim 1 Problem 1 Fall 2020 MAE 4730/4730

Mean 19.44 Median 18 Standard Dev 4.18



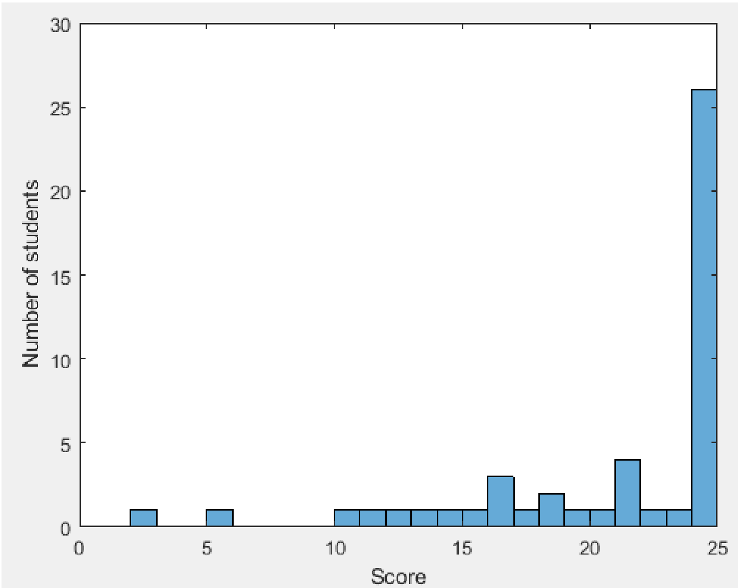
General Comments:

These two-body problems really tend to confuse people. I remember being confused by them too, it is still not 100% clear to me why. Maybe it feels funny to do LMB on things that are spinning. In any case, students had some trouble but managed to pick up partial credit in many places. Common mistakes:

- Doing LMB, but not realizing that the constraint that the two distances relative to the center of mass add to *d* allow you to solve for them and the angular velocity
- Not realizing that you can find those distances at all
- Math mistakes in solving for various quantities
- Incorrect angular momentum formulation, such as getting only m*w*d in terms of units
- Using angular momentum balance instead of just writing the angular momentum
- Writing the angular momentum about some point beside the center of mass
    - Oddly, the point was often one of the two masses, which is no good. Probably seems like a good point since the distance is just *d*.

Prelim 1 Problem 3 Fall 2020 MAE 4730/4730

P3 Mean 20.83 Median 25 Standard Dev 5.82



General Comments:

This problem tended to be hit-or-miss, with about half students (25 of them) knocking it out of the park, and the other half-ish (23) making many different types of mistakes and different combinations of them. With a problem like this, a result like this is not too surprising. These mistakes ranged from many different math mistakes to many different fundamental understanding mishaps. The most common mistakes I would say were (**NOTE: both happen to be kinematic and often also being some way related to vector mathematics**):

a) Issues with retrieving, expanding, or even thinking of the relative velocity relation $\mathbf{v}_{i/G}=\mathbf{v}_i-\mathbf{v}_G$.
   - Some expanded $(\mathbf{v}_{i/G})^2$ as $(\mathbf{v}_i)^2-(\mathbf{v}_G)^2$, missing out on the cross term and so on
   - Some did the expansion properly but improperly kept the cross term
   - Some argued that the cross term was zero incorrectly

b) Misunderstanding what happens to $\mathbf{v}_{i/G}$ in this case, such as
   - Assuming $\mathbf{r}_{i/G}$ being constant means $\mathbf{v}_{i/G}$ is zero, or wrong math getting that it is zero

Other mistakes included:

a)
   - A few people missed the definition of the center of mass position, which is what helps get rid of that pesky cross term

b)
   - Assuming the continuum limit needs to be taken. I did not take off points if this was done correctly, but we can get $I_G w^2/2$ with and without this limit.