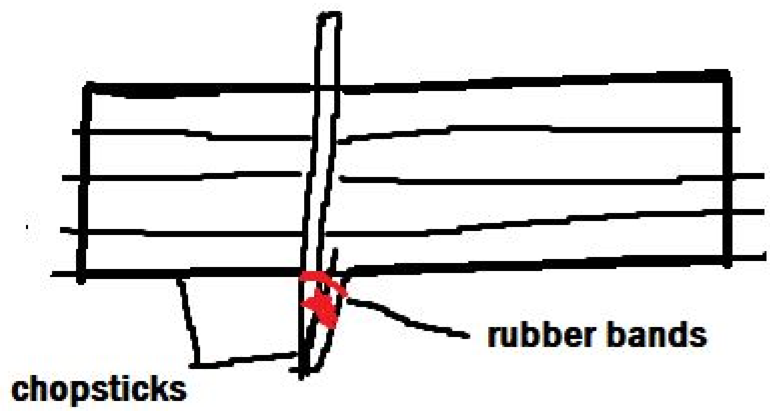
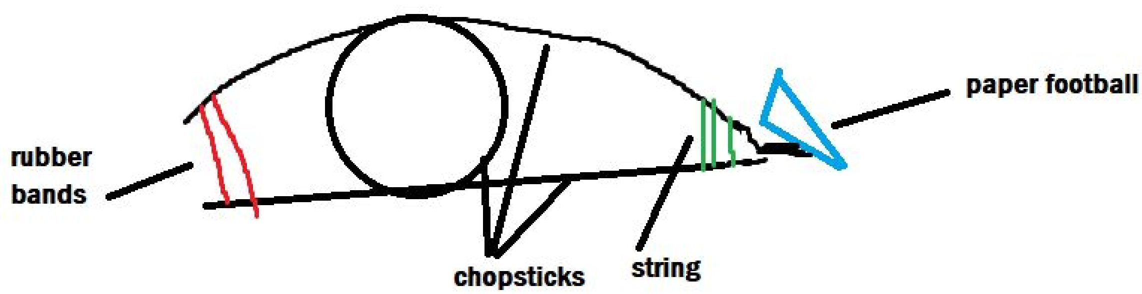
Risk Reduction

Sketches

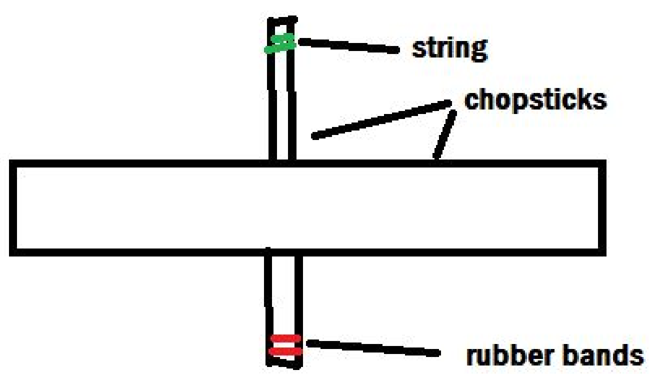
Front



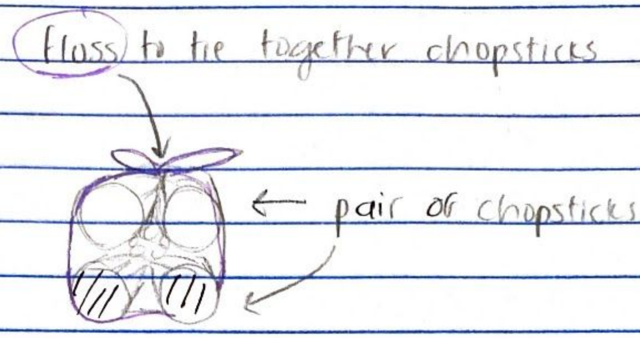
Side



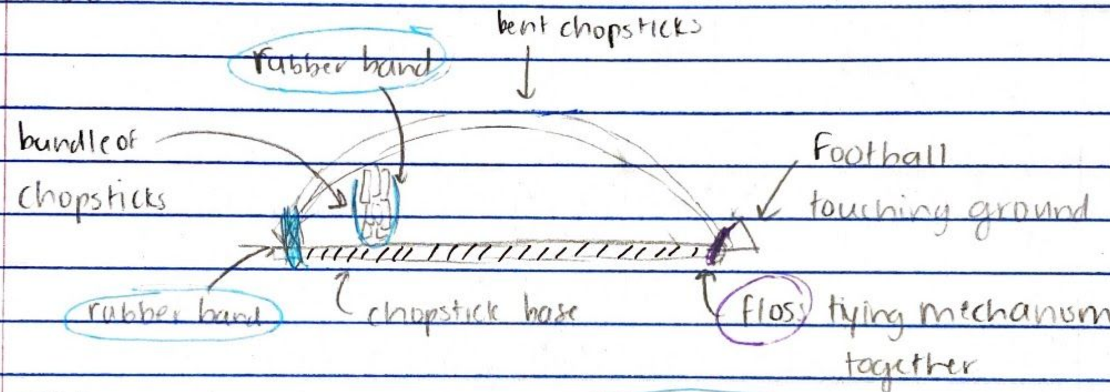
Top



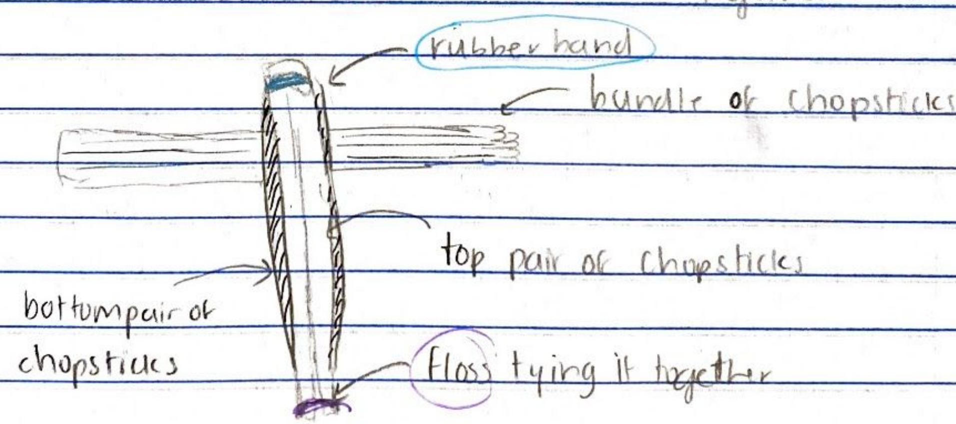
FRONT



SIDE



TOP



//// = bottom chopsticks
= Floss
= rubber band

Write-up

What worked:

When constructing our prototype, we found multiple parts of our component to be viable for a final competition prototype, such as the placement and usage of the rubber bands throughout the mechanism. The placement of the rubber band that bound together the cluster of chopsticks and its relationship to the clamp of the catapult mechanism was key, since it prevented the chopsticks in the middle from slipping out and providing inconsistent and unreliable results. By preventing a part of the mechanism from escaping, it allowed the mechanism to maintain its structural integrity, regardless of the conditions that are put on the system. Rubber bands served a significant role in the design, as we found that the introduction of more rubber bands in certain locations allowed us to prevent potential breakage of the components of our mechanism. For example, two more rubber bands were placed on each end of the cluster of chopsticks to further prevent movement in the cluster as the clamp part of the mechanism moves. In addition to this, a rubber band was placed at the end of the upper part of the "clamp" where the paper football would rest, which allowed the paper football to be launched in a parabolic path, rather than launching straight up. We used floss in order to bind together the upper and lower chopsticks in the catapult mechanism, which we found successful, as it was strong enough to secure the chopsticks together and easy to cut for an effortless release.

What didn't work:

The prototype was originally constructed with a set of thin, yet stiff rubber bands, which worked. However, when changing out the rubber bands in lieu of thicker, stronger bands that would allow for greater stability in our mechanism, there was more friction between the upper and lower pairs of chopsticks in the catapult, changing its shape and decreasing its ability to move. As a result, the rubber band had to be replaced with what was used beforehand. Additionally, we found that only one rubber band to bind together the clump of chopsticks in the middle was not satisfactory for keeping its shape together, as the upper and lower pairs of chopsticks in the catapult still affected its structural integrity. Lastly, resting the paper football on the bare chopstick was not successful, as it only launched the paper football vertically, rather than creating a force in the x and y directions, forcing us to adjust the platform on which we rested the paper football.

Risk Reduction decision:

Although the mechanism is successful in launching the paper football at a height and distance that will clear the football post, it does not follow all the rules specified for the competition. As a result, we will not move forward this football launching machine design for our competition prototype. However, due to its overwhelming success in launching the football at an impressive height and distance, we will use this design as inspiration for our future iterations of a football launching or kicking mechanism.

Remaining high risk issues:

- Durability of Chopsticks (Flex vs Break)
  - Test the maximum force the chopstick can handle before it breaks using a chopstick and hanging weights
- Strength of string
  - We can test different materials instead of string such as fishing line or tighter rubber bands to see how it affects the release point
- Optimal axis of rotation
  - Adjust the pivot (bundle of chopsticks) along the chopstick base to vary the axis of rotation of the catapult and analyze the launched distance
- Friction at the tying joint
  - Adjust the tying extent to avoid too loose condition (which influences the throwing mechanism) or too tight condition (which influences the chopsticks durability)
- Length of Chopstick for optimal distance
  - We can test chopstick lengths by either cutting them or connecting them up to the allowed dimension to see which length results in the farthest distance
- Height of chopstick cylinder to optimize angle of release
  - For this we can add or remove chopsticks from the inner point and find which angle results in the farthest launch distance