Structures Handout

Loads & Joints

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To insure a structure can hold heavier than typical loads, designers, engineers and architects often add extra members. They may also make some members stronger than minimally necessary. This is known as increasing the structures ***"factor of safety."***

Static and Dynamic Loads

As long as a person sits still on your chair the load is said to be static (or not moving.) If the user does not sit down gently or moves around while sitting the load is dynamic (or moving.) You have seen this when you discovered it is easier to break something with a quick shot than with a gradual and steady force. **Dynamic loads require greater structure strength or a higher factor of safety**.

Loads at Unexpected Locations.

Not everyone will sit on your chair where you planned. For example, they may sit on the front edge rather than towards the back of the seat. This would put a greater load on the front columns, requiring them to carry a load that would have been distributed among several columns or other load bearing members. Therefore it is useful to **plan your structure for the person who may not follow your instructions about where to sit**.

Unfortunately, the "Chair Design Challenge" has strict economic specifications. The strength of the material available and the amount of it may not allow you to make your chair strong enough to increase its factor of safety. Thus, you will have to **work to get the most from the least**.

Making Joints Tight

Keeping in mind that your chair will fail at its weakest link, you should make slots that will not allow any motion or "play" of the members as they sit in the joints. (Joints are where members are joined together.) **You should try to cut all slots carefully so they are straight, parallel and the exact width of the material that will fit into them**. Undesired play can allow a column to shift from being vertical. It can also lead to your chair swaying which in turn can lead to material tearing and breaking. Many chairs fail from unwanted swaying.

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Homework Questions

1. Explain what “factor of safety means in engineering design.

2. Explain the difference between a static load and a dynamic load.

3. Is it possible to plan for how the consumer will use the product?

   If not, how can you engineer it to work even if not used exactly as designed?

4. Why is it important for joints to be tight and not loose?