**Forks:**

Overview of forks:

* Each block has their own block height for example block height 1, 2 3 4, etc
* A fork is **when you have to blocks at the same heigh**t basically one block above the other block that is in the blockchain, and they are not the same block.
* The the block that is above the block in the chain can aso be built upon and form a seperate chain, usually the network disregards one of the chains (the longest chain with most proof of work, and the others would be stale blocks)
* Can happen accidental (miners finishing and creating blocks at the same time), Can happen from updates (updte to the consensus rule)

Accidental forks:

* Fork that was not intended
* Usually happens when the miner create a block at the same time.

Updates and forks:

* Hard forks and soft forks
* They take place when we have a update on the consensus rules ( the rules that must be checked for a block to be valid) . For example that transactions are valid and block size is valid= 1 mbt.
* This can lead to different forks depending on the nature of the update. Difficult to get all the nodes to update at the same time. Because then some nodes have different consensus rules for a period of time depending on when they are updated. Goal is to get all the nodes to update.

Hard forks:

* An update that leads to a hard fork is a update tha makes previusly invalid blocks valid. For example Blocks must be smaller or equal to 1mb, update: we will change the rules so that a valid block must be smaller or equal to 2mb.
* In the network before the update everyoone uses the rule of 1mb.
* The problem appears because in order to not create a fork we need 100% of the network to update.
* If only 60% updates, then the nodes that ahve been updated will append 2mb blocks while the 40% wil not append it and disregard it. This will create to versions of the blockchain that bot hare valid according to the nodes. The 60% that updated will also accept 1mb blocks but because 40% wont we will get a fork, and the other 40% will then have created a new currency.
* Example of this is bitcoin cash, SV, gold and diamonnd.

Soft fork:

* An update that makes previusly valid blocks invalid.
* For example we lover the block size from 1mB to 0,5mB. Consensus rule will change. Oppostie direction of hard for, tightening rules instead of exapnding.
* If 60% update and 40% dont then we have created a fork.
* If a block comes along that is 0,5mB then both the nodes before and afeter the update will accept the block. If a node that have not updated appends a block with the sizze of 1mb then only the nodes that have not updated will append it and and the ones that have updated will not accept it. This will create a fork
* The red nodes still validates the chain of the updated nodes, since a majority of the nodes updated that chain will grow alot faster. The nodes always validates the longest chain (most POW) therefore, the nodes that hav enot updated will eventually join the chain of the updated nodes. But the blocks they create over 0,5mB willl never be appended to this chain.
* If atleast 50% of the hashpower (the miners) updates, then it will lead to no fork (long term).
* If less than 50% update then we will have a fork. Where the nodes that updated wont validate the blocks of the nodes that did not update therefore they will continue on seperate chains because the ones that did not upadte will continue on the longest chain.
* People generally like a soft fork better than a hard fork.

Soft fork and hard fork:

* Hard fork is an expansion (previusly invalid blocks valid, and a soft work is a contraction (previusly valid blocks invalid).

Pros and cons with soft forks and hard forks:

Hard forks:

Pros: Clear update ( if you dont update, you will be on the previus chain), democratic type update

Cons: we split the chain and the community, and we get a new currency (can be a pro), hash power will be decreased which reduces security.

Soft forks:

Pros: Majority rule, no chain split (mostly), keeps the communityh together,

Cons: None democratic (force the other nodes to stay on the main chain even though they dont update). Confusion,

Homework:

1. A hard fork makes previusly invalid blocks valid, and a soft fork makes previusly valid blocks invalid.
2. The reasons to do a hard fork is to update the consensus rules, and it will make a chain with the new consensus rules without fail.
3. The risks of performing a hard fork is that the community will be split because in most cases not all 100% of the nodes updtade. Hash power will be reduced if not all the miners update, that leads to decreased security.