Pipeline Control Hazards - short note

Take Home Assignment

Computer Architecture

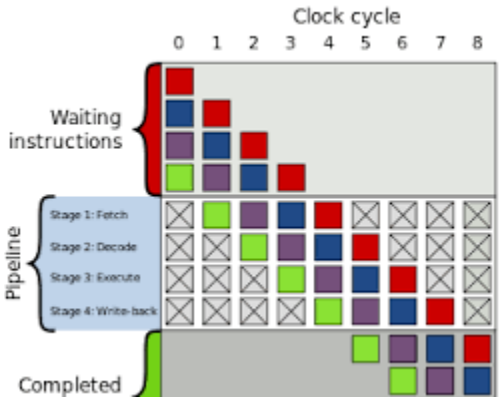
210598B

Pipeline control hazards occur when the processor cannot predict the outcome of a conditional branch instruction and fetches and executes the wrong instructions. This can waste time and resources.

1. **Freeze or flush the pipeline. -**

   Freezing involves stopping the pipeline from fetching and executing new instructions until the outcome of the conditional branch instruction is known. This is a simple and effective way to reduce pipeline control hazards, but it can lead to performance degradation.

   Flushing involves discarding all the instructions that are currently in the pipeline and starting over. This is a more complex way to reduce pipeline control hazards, but it can lead to better performance than freezing the pipeline.



2. **Predicted-untaken.**

   A branch prediction technique that assumes that all conditional branches will be not taken. This is the simplest branch prediction technique, but it is also the least accurate.

   Predicted-untaken is typically used in processors with simple pipelines, such as RISC processors. This is because it is relatively easy to implement and does not require a lot of hardware resources.

3. **Predicted-taken.**

   predicted-taken is a branch prediction technique that assumes that all conditional branches will be taken. This is a more aggressive branch prediction technique than predicted-untaken, and it can lead to better performance, but it is also more likely to mispredict.
   Predicted-taken is typically used in processors with more complex pipelines, such as CISC processors. This is because predicted-taken requires more hardware resources to implement, but it can lead to significant performance improvements.

4. **Delayed branch.**

   Delayed-branch is a technique that can be used to reduce the impact of branch mispredictions. Delayed-branch works by always fetching and executing the instruction that follows a conditional branch instruction.

   If the conditional branch is taken, the processor will flush the pipeline and start fetching and executing the instructions at the target address. If the conditional branch is not taken, the processor will continue executing the instructions in the pipeline.