4. Discuss **branch prediction**: Why is it important? How does it work? What are the most important issues? Include thoughts on aliasing and correlation.

When a branch is predicted incorrectly, instructions processed by the pipeline before the direction and target are known (i.e., before EX) must be flushed, thus decreasing performance.

If more sophisticated branch prediction were used, the direction/target can be guessed more accurately.

The methods have been explored:
- **Adaptive prediction**
  - Training
  - History register
  - Previous branches

Hybrid systems (both methods)

- **GA** (global HR), **GBP** (global prediction table)
- **PA** (private HR), **GAP** (global prediction table)
- **PAP** (private HR, private PT)
- **GAP** (global HR, private PT)

Of all the methods, **GAP was originally considered bad because of prevention aliasing problems (strongly biased HR data pointing to the same PT)**

cont.
IT was eventually found that GAP was a good approach, because global patterns of branch history exhibit strong correlations on the behavior of the algorithm being executed.Aliases are beneficial because of branch conflict...

Predicted, previous related branches show behaviors for predicting branch confidence.