CS-311 Assignment4

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Details on cycles, OF stage stalls, and Wrong Branch Instructions:

Without Pipeline

TEST CASE	Hash of state	Number of instructions	Number of cycles
descending.out	255541867	277	1135
evenorodd.out	-224294686	6	30
fibonacci.out	-1518357572	78	390
palindrome.out	155317940	49	245
prime.out	-1414219998	29	145

With Pipeline

TEST CASE	Hash of state	Number of cycles	No of OF stalls	No of Wrong branch instructions
descending.out	255541867	658	126	220
evenorodd.out	-224294686	19	10	4
fibonacci.out	-1518357572	157	44	36
palindrome.out	155317940	124	51	18
prime.out	-1414219998	79	19	28

Observations

We observe that the hash of the state is the same in both cases so our pipelined processor program is functionally correct. The number of cycles taken by each program with pipeline implementation dropped substantially to half of the program without the pipeline. In an ideal case, it may reduce to one-fifth of total number of cycles. In ideal conditions, the speedup of a pipelined processor w.r.t non-pipelined processor is 5, but the ideal conditions are mostly not met because of various data hazards. The number of wrong branch instructions and the number of OF stalls are also affected depending on the number of data hazards in a program. So, in the case of data hazards, we insert a bubble into the pipeline which increases the number of cycles. In case of wrong branch instructions, we replace them with bubbles (nops).