Lecture 08 ()

1 Choosing Instructions

1. We have a tree structure to choose the instruction which is "granted" permission to execute out of the instructions which "request" execution
2. The instruction which finally gets chosen is then executed
3. Each node is a "choice box" which stores information about which instruction it chose

1.1 Utilizing Resources

1.1.1 Chaining Select Units

1. One instruction is selected at a time
2. The request is xor'ed with grant bit for the next request

1.1.2 Elaborate Choices

1. Choice box selects $n > 1$ instructions
2. Needs better logic

1.1.3 Asymmetric Select Unit

1. Interesting computer science
2. Have n select units with different policies
3. In case of tie, select unit i, give priority to i^{th} input

1.2 Select Policies

1. Random
2. Oldest first (*seniority is a priority*)
3. Type of opcode
    - load instructions have higher priority
    - other priorities can be learnt based on execution pattern

2 Broadcasting the Tag

2.1 RAW Dependencies

```
add r1 r2 r3
add r4 r1 r5
```

1. We want back to back execution (consecutive cycles)
2. This implies that wakeup and select has to happen in same cycle

2.2 Optimal Pipeline

1. Rename
2. Dispatch
3. Wakeup + select
4. Register read + broadcast
5. Execute
6. Register write

We can ~~forward~~ bypass the data (*senior gives 2nd semester's notes assuming you pass*)

Sir's friend got selected in civil services. Even before training finished (and posting happened), he updated his shaadi.com profile.

2.3 Load Use Hazard

you won't be posted until next elections since your uncle is CM and he doesn't like you :(

1. Broadcasting is done in the first execute stage (execute is of 2 cycles)
2. More generally, if execute stage is k cycles, broadcast k cycles after select
3. Variable length is implemented using state machines - FU knows its delay (except for load/store unit)

3 When should Available Bit in Rename be set?

1. Mark it along with the broadcast for wakeup
2. Alternatively, have double broadcast: in the next cycle, update IW entry for the broadcasts in the last cycle