

Finite State Machines

	S	L	R		S'	TR	TL	F
LOST	00	0	0		00	0	0	1
	00	1	-		01	0	0	1
	00	0	1		01	0	0	1
RCCW	01	1	-		01	0	1	0
	01	0	1		01	0	1	0
WALL1	10	0	0		10	0	1	0
	10	-	0		10	1	0	1
	10	-	1		11	1	0	1
WALL2	11	1	-		01	0	1	1
	11	0	0		10	0	1	1
	11	0	1		11	0	1	1

Comp 120 - Spring 2005
3/31/05
Q2 - review 1

A Pipelining Methodology

Step 1:
Draw a line that crosses every output in the circuit, and select one endpoint as an origin.

Step 2:
Continue to draw new lines from the origin across various circuit connections such that these new lines partition the inputs from the outputs.

Adding a pipeline register at every point where a separating line crosses a connection will always generate a valid pipeline.

STRATEGY:
Focus your attention on placing pipelining registers around the slowest circuit elements (BOTTLENECKS).

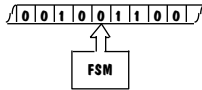
In these examples we assume "idealized" pipeline registers, with $t_{pd} = 0$ and $t_s = 0$.

$T = 1/8ns$
 $L = 24ns$

Comp 120 - Spring 2005
3/31/05
Q2 - review 2

Computability vs. Programmability

Turing Machine = FSM + Tape (aka Infinite State Machine)

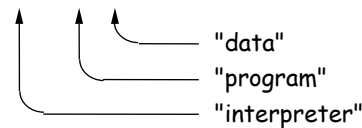


Computability: whatever Turing Machines can do

Programmability:

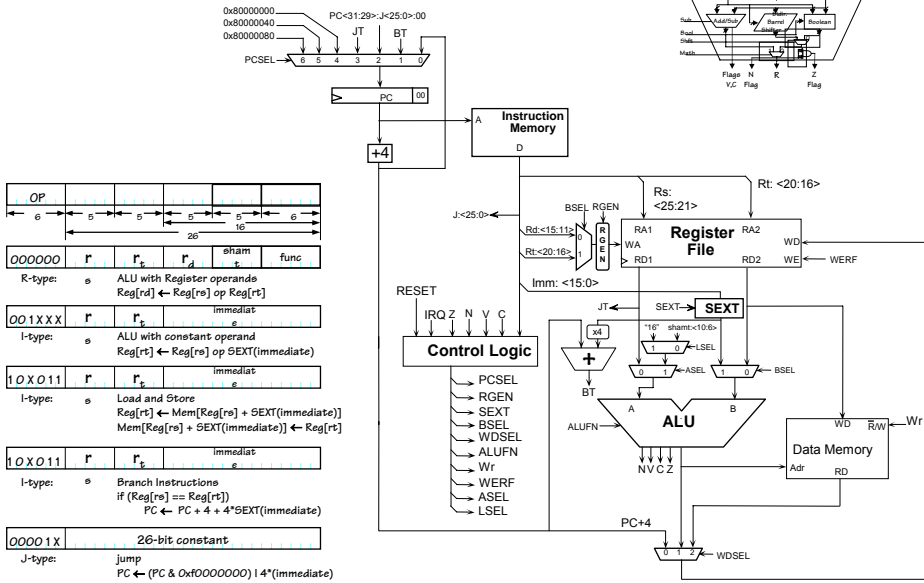
Universal Turing Machine (UTM):

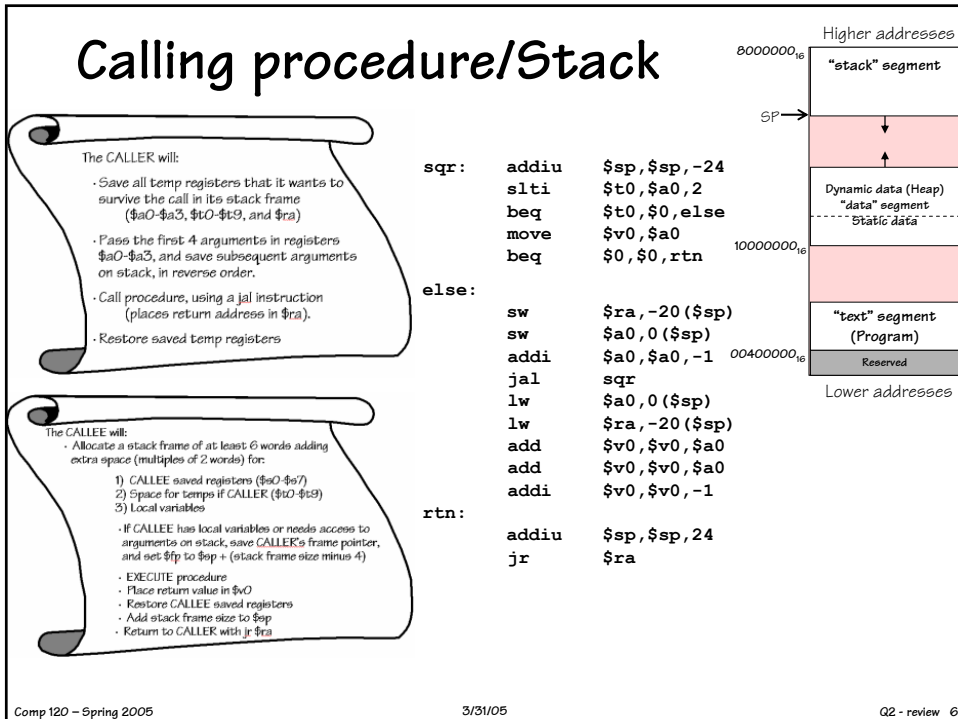
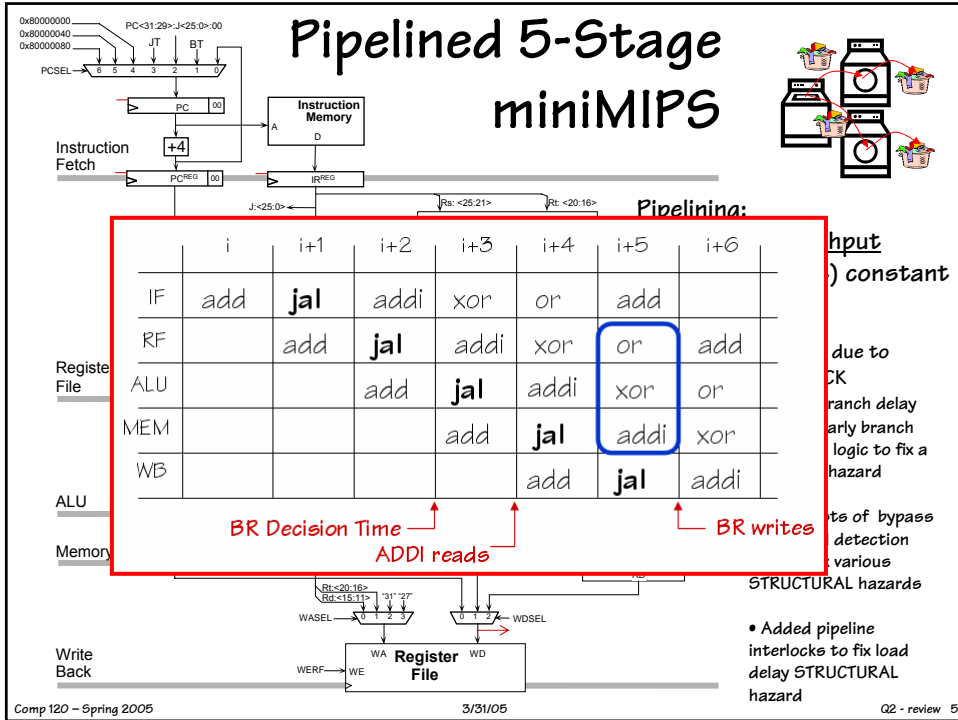
$$T_U[\langle \gamma, z \rangle] = T_\gamma[z]$$



PARADIGM for General-Purpose Computer!

MiniMIPS





Performance

Measures: MIPS, MIPS/\$, MIPS/Watt

(but also ISA,...)

$$\text{MIPS} = \frac{\text{Freq}}{\text{CPI}}$$

→ pipelining, ...

→ reduce stalls (caches, bypasses,...), parallelism (superscalar, VLIW, ...), ...

Amdahl's law

$$t_{\text{improved}} = \frac{t_{\text{affected}}}{r_{\text{speedup}}} + t_{\text{unaffected}}$$

Benchmarks

Benchmark	Description
compress	Compresses the file compress.o into compress.o.gz
gcc	Compiles the file test.c into test.o
grep	Searches for the string 'hello' in the file test.o
lisp	Executes the file test.lisp
lisp2	Executes the file test2.lisp
lisp3	Executes the file test3.lisp
lisp4	Executes the file test4.lisp
lisp5	Executes the file test5.lisp
lisp6	Executes the file test6.lisp
lisp7	Executes the file test7.lisp
lisp8	Executes the file test8.lisp
lisp9	Executes the file test9.lisp
lisp10	Executes the file test10.lisp
lisp11	Executes the file test11.lisp
lisp12	Executes the file test12.lisp
lisp13	Executes the file test13.lisp
lisp14	Executes the file test14.lisp
lisp15	Executes the file test15.lisp
lisp16	Executes the file test16.lisp
lisp17	Executes the file test17.lisp
lisp18	Executes the file test18.lisp
lisp19	Executes the file test19.lisp
lisp20	Executes the file test20.lisp
lisp21	Executes the file test21.lisp
lisp22	Executes the file test22.lisp
lisp23	Executes the file test23.lisp
lisp24	Executes the file test24.lisp
lisp25	Executes the file test25.lisp
lisp26	Executes the file test26.lisp
lisp27	Executes the file test27.lisp
lisp28	Executes the file test28.lisp
lisp29	Executes the file test29.lisp
lisp30	Executes the file test30.lisp
lisp31	Executes the file test31.lisp
lisp32	Executes the file test32.lisp
lisp33	Executes the file test33.lisp
lisp34	Executes the file test34.lisp
lisp35	Executes the file test35.lisp
lisp36	Executes the file test36.lisp
lisp37	Executes the file test37.lisp
lisp38	Executes the file test38.lisp
lisp39	Executes the file test39.lisp
lisp40	Executes the file test40.lisp
lisp41	Executes the file test41.lisp
lisp42	Executes the file test42.lisp
lisp43	Executes the file test43.lisp
lisp44	Executes the file test44.lisp
lisp45	Executes the file test45.lisp
lisp46	Executes the file test46.lisp
lisp47	Executes the file test47.lisp
lisp48	Executes the file test48.lisp
lisp49	Executes the file test49.lisp
lisp50	Executes the file test50.lisp
lisp51	Executes the file test51.lisp
lisp52	Executes the file test52.lisp
lisp53	Executes the file test53.lisp
lisp54	Executes the file test54.lisp
lisp55	Executes the file test55.lisp
lisp56	Executes the file test56.lisp
lisp57	Executes the file test57.lisp
lisp58	Executes the file test58.lisp
lisp59	Executes the file test59.lisp
lisp60	Executes the file test60.lisp
lisp61	Executes the file test61.lisp
lisp62	Executes the file test62.lisp
lisp63	Executes the file test63.lisp
lisp64	Executes the file test64.lisp
lisp65	Executes the file test65.lisp
lisp66	Executes the file test66.lisp
lisp67	Executes the file test67.lisp
lisp68	Executes the file test68.lisp
lisp69	Executes the file test69.lisp
lisp70	Executes the file test70.lisp
lisp71	Executes the file test71.lisp
lisp72	Executes the file test72.lisp
lisp73	Executes the file test73.lisp
lisp74	Executes the file test74.lisp
lisp75	Executes the file test75.lisp
lisp76	Executes the file test76.lisp
lisp77	Executes the file test77.lisp
lisp78	Executes the file test78.lisp
lisp79	Executes the file test79.lisp
lisp80	Executes the file test80.lisp
lisp81	Executes the file test81.lisp
lisp82	Executes the file test82.lisp
lisp83	Executes the file test83.lisp
lisp84	Executes the file test84.lisp
lisp85	Executes the file test85.lisp
lisp86	Executes the file test86.lisp
lisp87	Executes the file test87.lisp
lisp88	Executes the file test88.lisp
lisp89	Executes the file test89.lisp
lisp90	Executes the file test90.lisp
lisp91	Executes the file test91.lisp
lisp92	Executes the file test92.lisp
lisp93	Executes the file test93.lisp
lisp94	Executes the file test94.lisp
lisp95	Executes the file test95.lisp
lisp96	Executes the file test96.lisp
lisp97	Executes the file test97.lisp
lisp98	Executes the file test98.lisp
lisp99	Executes the file test99.lisp
lisp100	Executes the file test100.lisp

