

# HW #3

for

99x .5 cond

.5  
PREDICT\_NOT\_TAKEN

for — cond

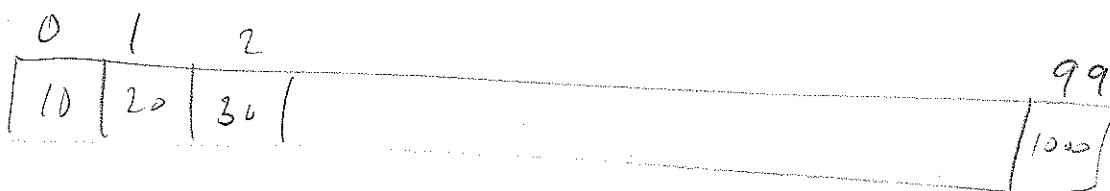
PREDICT\_NOT\_TAKEN

if — cond

No good prediction

end for — uncond

end for e — uncond



(i) Without BHT:

(Always taken)

2	outer for	outer for unconditional at end for	inner for	inner for uncond. at end for	if cond
4		$2 \times 99 = 198$	$4 \times 99 = 396$	$2 \times (99 + 98 + \dots + 2 + 1) = 9900$	$4 \times (99 + 98 + \dots + 2 + 1) = 19800$
Total = 30,298 cycles branch penalty					

(ii) With one bit BHT

2	outer for	outer end for	inner for	inner end for	if cond
4		2	$4 + 8 \times 99$	2	4
= 800 cycles					

(iii) With 2-bit BHT

$\frac{1}{6}$	outer for	outer end for	inner for	inner end for	if cond
4		2	$4 \times 99$	2	4
= 408 cycles HW3-1					