

**NC State University**  
**Department of Electrical and Computer Engineering**  
**ECE 463/563: Fall 2021 (Rotenberg)**  
**Project #3: Dynamic Instruction Scheduling**

**by**

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NCSU Honor Pledge: "I have neither given nor received unauthorized aid on this project."

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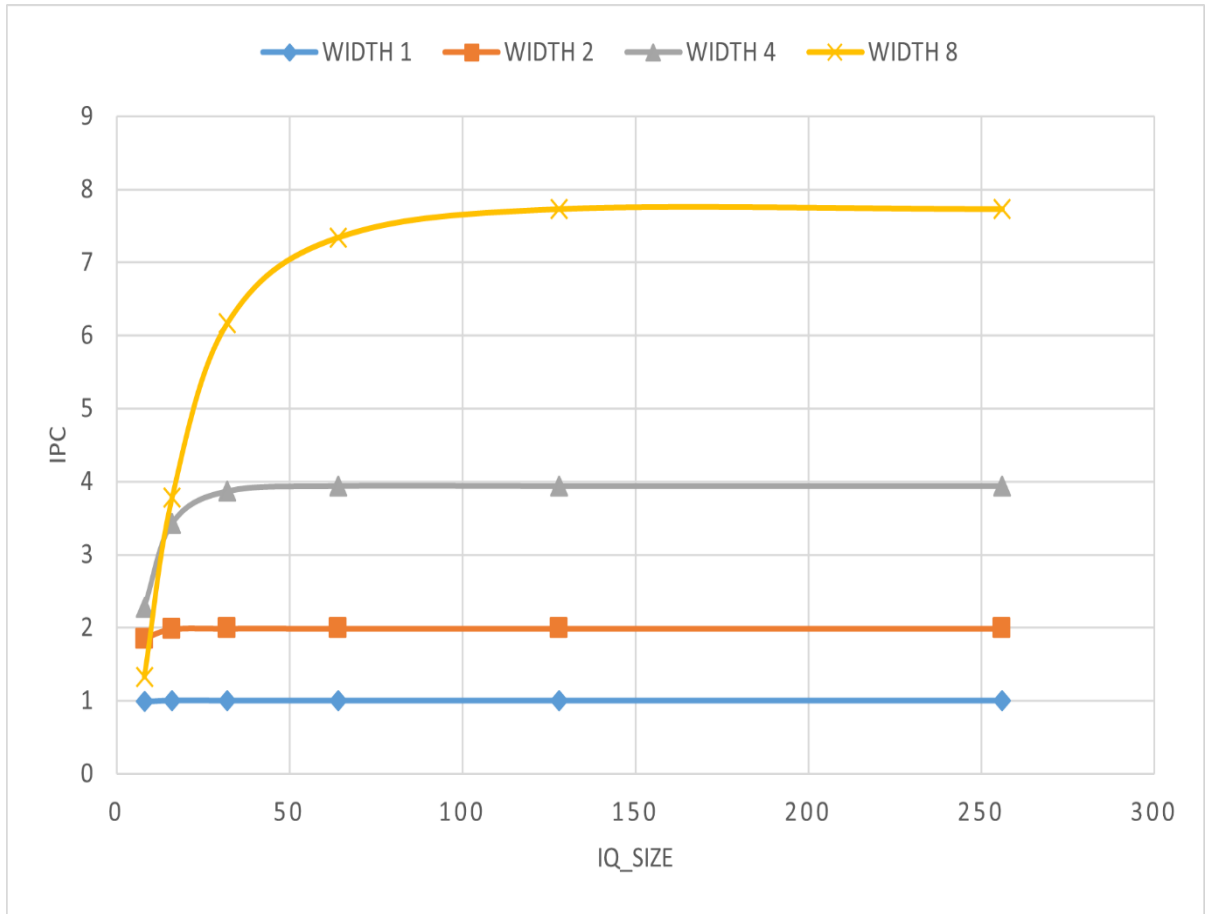
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Course number: \_\_\_\_\_563\_\_\_\_\_

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## 1. Large ROB, effect of IQ\_SIZE

### 1.1 Trace\_gcc

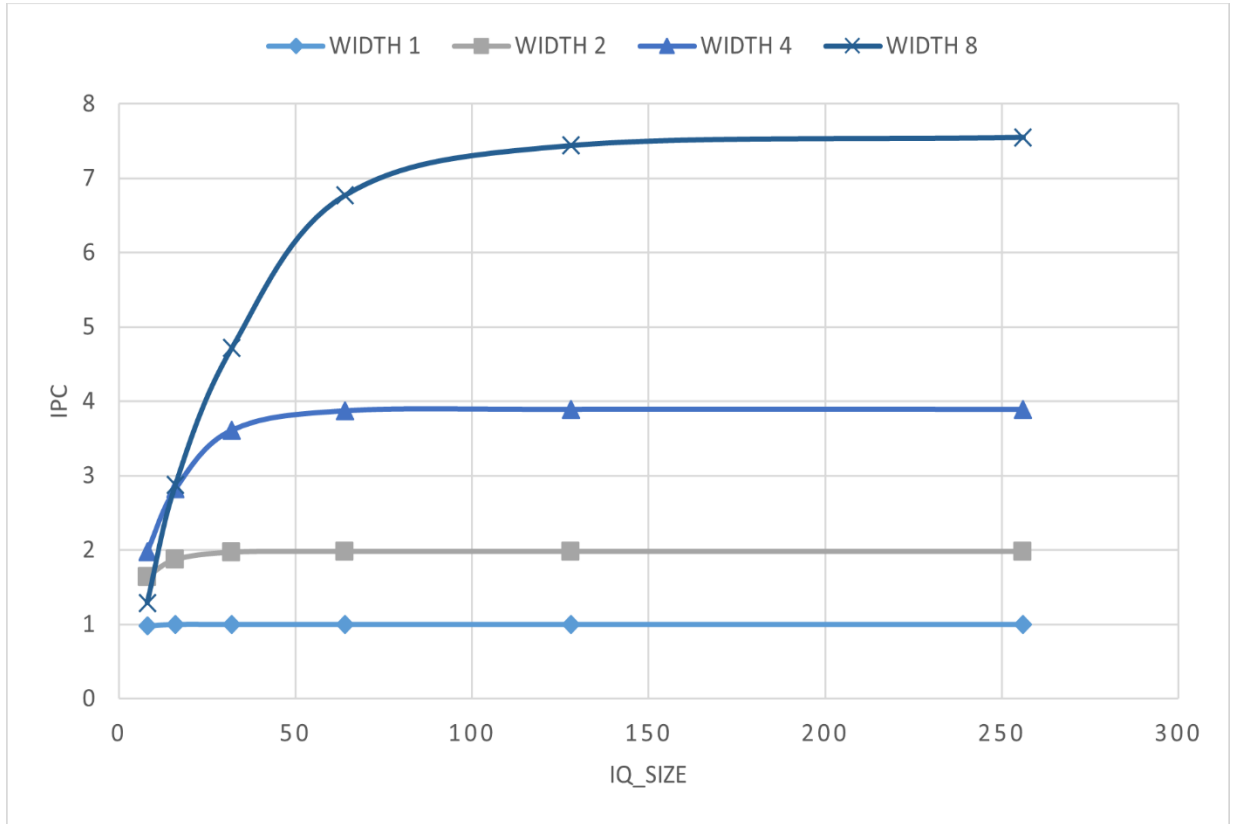


Graph 1: trace\_gcc IQ\_SIZE Vs IPC

IQ_SIZE	W=1	W=2	W=4	W=8
8	0.99	1.85	2.28	1.33
16	1	1.98	3.43	3.78
32	1	1.99	3.87	6.17
64	1	1.99	3.94	7.34
128	1	1.99	3.94	7.73
256	1	1.99	3.94	7.73

Table 1: Trace\_gcc1

## 1.2 Trace\_perl



Graph 2: trace\_perl IQ\_SIZE Vs IPC

IQ_SIZE	W=1	W=2	W=4	W=8
8	0.98	1.64	1.98	1.29
16	1	1.87	2.82	2.88
32	1	1.97	3.61	4.72
64	1	1.98	3.87	6.77
128	1	1.98	3.89	7.44
256	1	1.98	3.89	7.55

Table 2: Trace\_perl1 values

## 1.3 Graph Analysis

	<b>“Optimized IQ_SIZE per WIDTH”</b> Minimum IQ_SIZE that still achieves within 5% of the IPC of the largest IQ_SIZE	
	Benchmark 1	Benchmark 2
W=1	8	8
W=2	16	32
W=4	32	64
W=8	128	128

## Discussion

In the first experiment, keeping the size of ROB constant, by increasing the size of Instruction Queue while changing Width, Instruction per cycle proportionally increases a well.

The best IPC value is achieved at Width=8 and IQ size= 128. Similar results can be achieved with just 5% less value range with a IQ size lower than it.

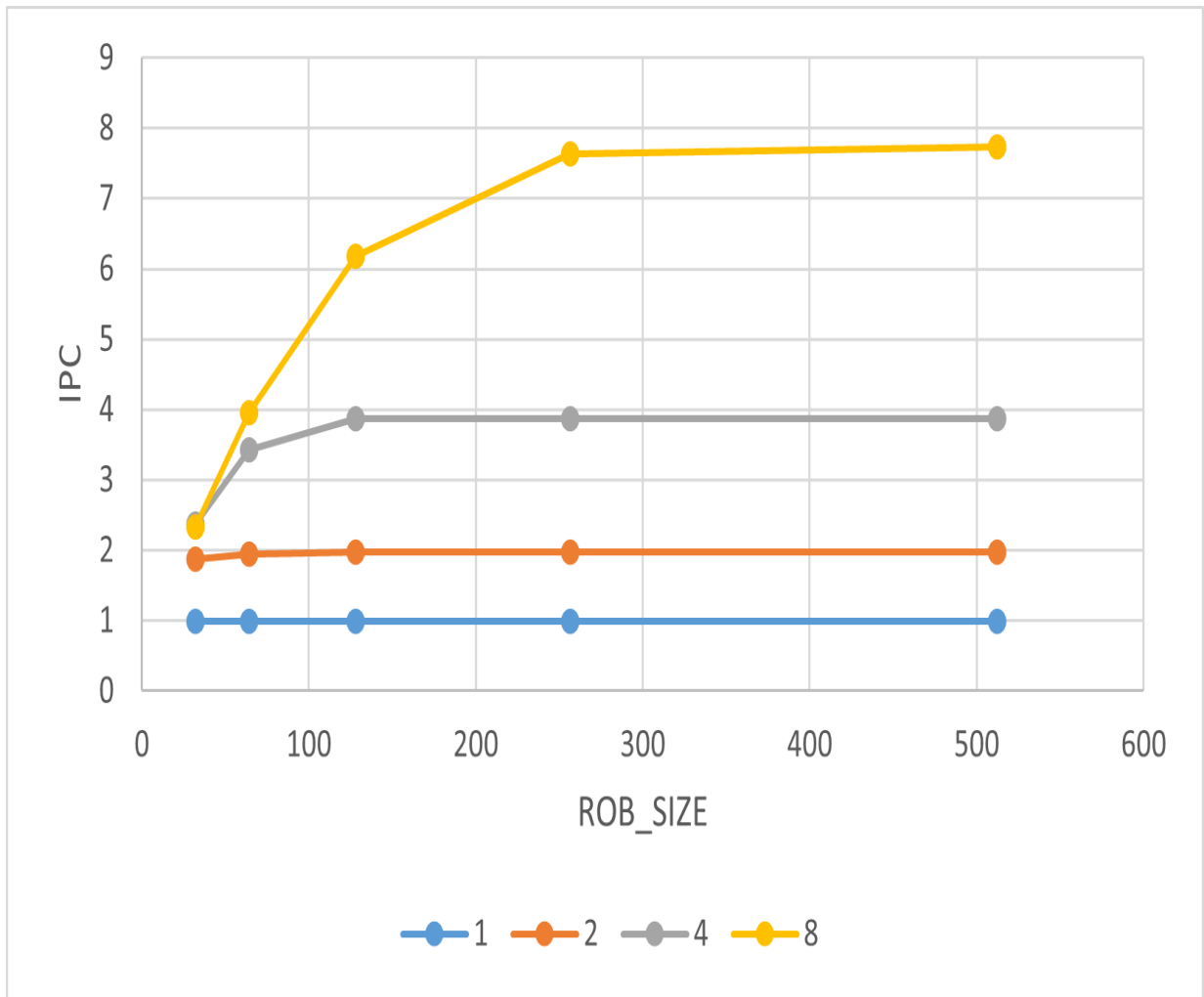
The ideal value of IPC is the width size. The IPC keeps on increasing till a saturation point is reached. The saturated value is less than Width but very close to ideal value. Increasing the Width brings the superscalarity and provides parallelism.

The difference between ideal value and achieved value keeps on increasing as we increase width. For e.g.:

For gcc trace file, we can see for w=1 the ideal value is 1 and achieved value is 1 , similarly for w=2, achieved value is 1.99, w=4, achieved value=3.94 and for w=8 the achieved value is 7.73.

For perl trace file, we can see for w=1 the ideal value is 1 and achieved value is 1 , similarly for w=2, achieved value is 1.98, w=4, achieved value=3.89 and for w=8 the achieved value is 7.55.

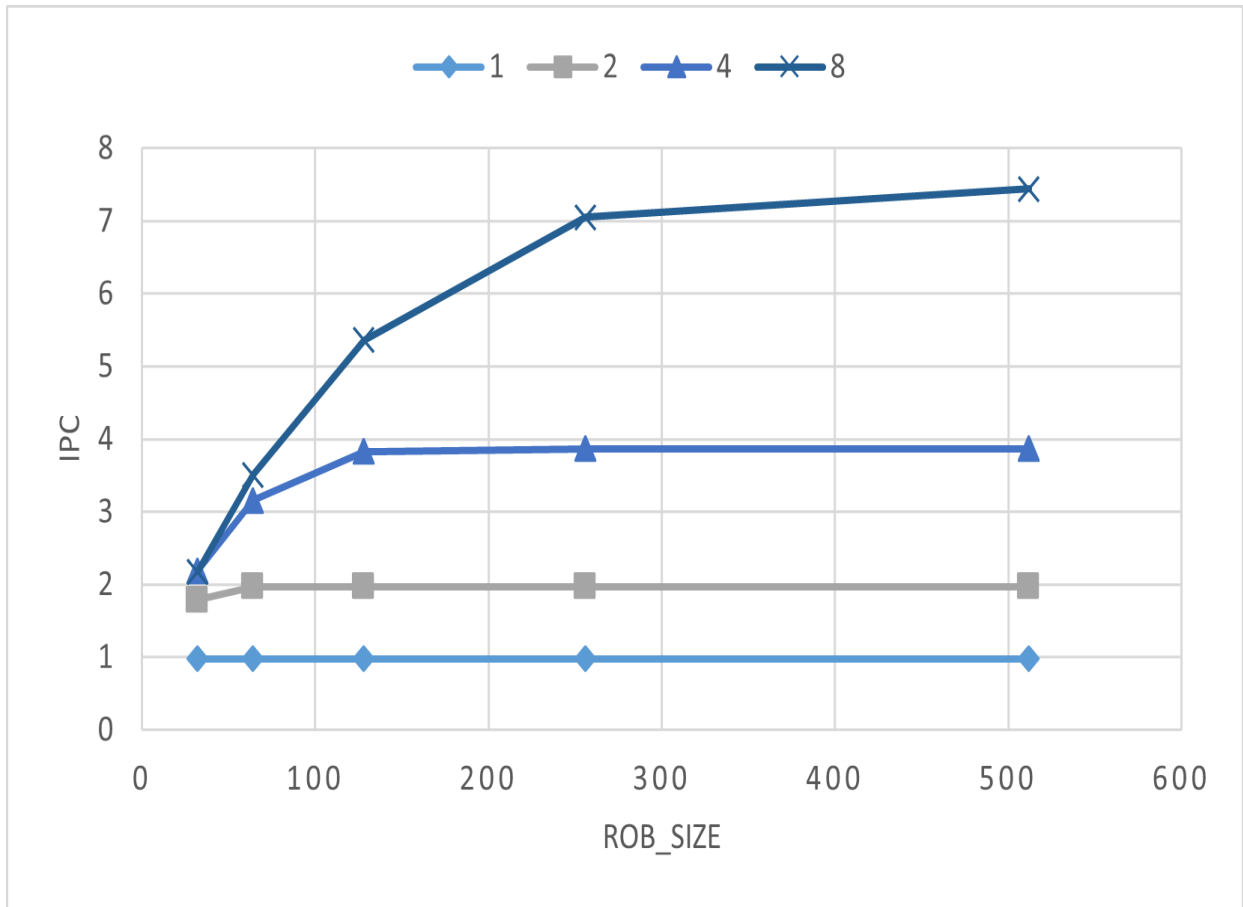
## 1.4 EFFECTS OF ROB\_SIZE



Graph 3: trace\_gcc effect of ROB\_size

TRACE\_GCC

	1	2	4	8
32	0.99	1.88	2.38	2.33
64	0.99	1.95	3.43	3.96
128	0.99	1.98	3.87	6.18
256	0.99	1.98	3.87	7.63
512	0.99	1.98	3.87	7.73



Graph 4: Trace\_perl, effect of ROB\_size

#### TRACE\_PERL

	1	2	4	8
32	0.98	1.79	2.19	2.18
64	0.98	1.97	3.16	3.51
128	0.98	1.97	3.83	5.36
256	0.98	1.97	3.87	7.05
512	0.98	1.97	3.87	7.44