

Benchmark Report

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Summary of Problems

#	Problem	Objective	Ref Sol
1	4x4 Matrix Multiplier	↓ LUT	PASS
2	16-Tap Symmetric FIR Filter	↓ Power	PASS
3	Pipelined 8-Tap FIR Filter	↑ Fmax	PASS
4	Streaming 3x3 CNN Convolution Layer	↑ Fmax	PASS
5	Sobel Edge Detection Accelerator	↑ Fmax	PASS
6	AES-128 Encryption Engine	↓ LUT	PASS
7	Streaming Pipelined AES-128 Encryption	↑ Frequency	PASS
8	G-Share Branch Predictor	↓ LUTs	PASS
9	Dual-Port Register File	↓ LUT	PASS
10	8-Bit Single-Cycle ALU with Flags	↑ Fmax	PASS
11	Direct-Mapped Write-Through Cache	↓ LUT	PASS
12	Fixed-Point Softmax Approximation Layer	↓ LUT	PASS
13	Hardmax One-Hot Classifier	↓ LUT	PASS
14	IPv4 Header Sniffer	↓ LUT	PASS
15	Longest Prefix Match Router	↓ LUT	PASS
16	Priority-Based Packet Filter	↓ LUT	PASS
17	Key-Value Database with Round-Robin Replacement	↓ LUT	PASS
18	CRC-32 Generator	↓ LUT	PASS
19	Iterative CORDIC Sin/Cos	↓ LUT	PASS
20	Pipelined CORDIC Sin/Cos	↑ Fmax	PASS
21	Fixed-Point PID Robot Position Controller	↓ LUT	PASS
22	Fixed-Weight Perceptron	↓ LUT	PASS
23	Streaming FIX Message Decoder	↑ Fmax	PASS
24	Keypad Access Control FSM	↓ LUT	PASS
25	64-bit Popcount with Threshold Flag	↑ Fmax	PASS
26	Complementary PWM Generator with Dead-Time	↓ LUT	PASS
27	Streaming Run-Length Encoder	↑ Fmax	PASS
28	Sliding-Window Heart-Rate Estimator	↓ LUT	PASS
29	4-Point Complex FFT	↓ LUT	PASS
30	AXI4-Stream 8-to-32 Upsizer	↓ LUT	PASS
31	Hamming SECDED Decoder	↓ LUT	PASS
32	Priority Interrupt Controller	↓ LUT	PASS
33	Asynchronous Dual-Clock FIFO	↓ LUT	PASS
34	8-Port Round-Robin Arbiter	↓ LUT	PASS
35	SPI Mode-0 Master	↓ LUT	PASS
36	Oversampled 8N1 UART Receiver	↓ LUT	PASS
37	ECG R-Peak Detector	↓ LUT	PASS
38	7-Sample Median Denoising Filter	↓ LUT	PASS
39	Single-Cycle RV32I Micro Core	↓ LUT	PASS
40	Triple-Hash Bloom Filter Engine	↓ LUT	PASS
41	64-Bin Streaming Histogram Engine	↑ Fmax	PASS
42	Fixed-Ladder Top-of-Book Builder	↑ Fmax	PASS

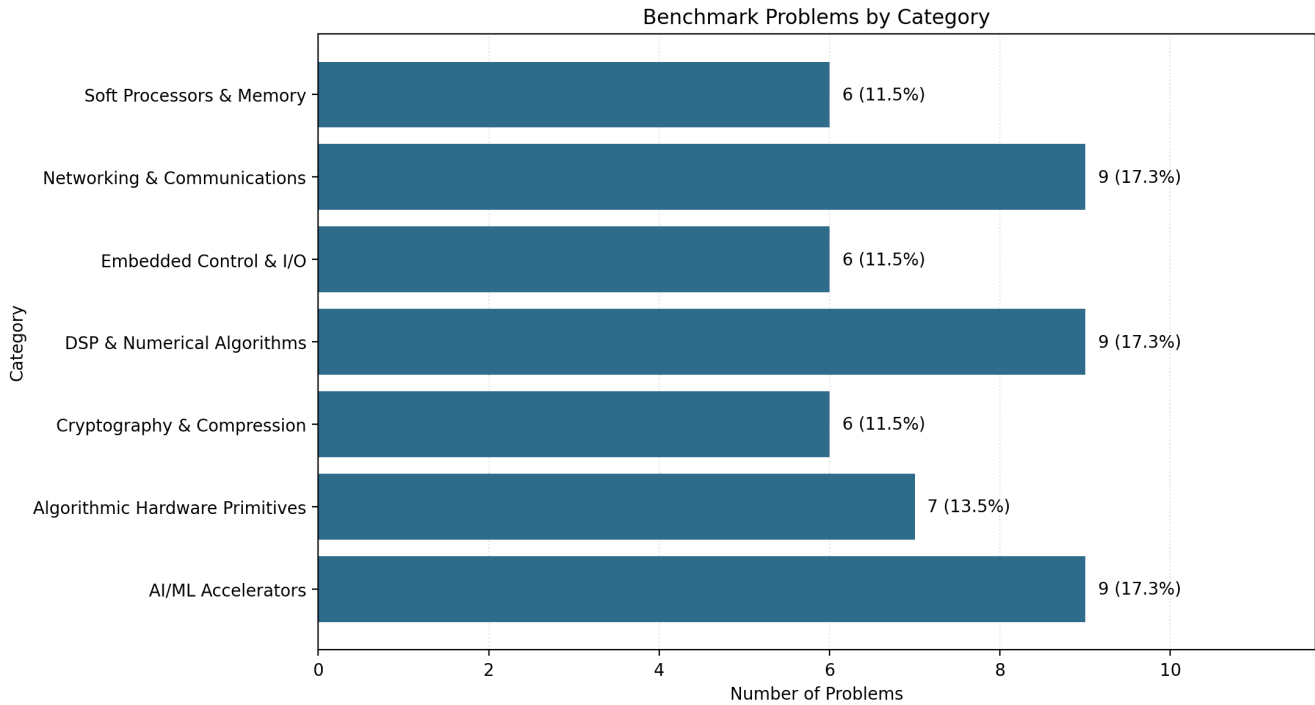
#	Problem	Objective	Ref Sol
43	Parallel Bitonic Sort and Rank Engine	↑ Fmax	PASS
44	16x8 Binarized Dense Layer	↓ LUT	PASS
45	Parallel Prefix Sum Unit	↑ Fmax	PASS
46	Token Bucket Rate Limiter	↓ LUT	PASS
47	8-Entry TCAM Lookup	↓ LUT	PASS
48	2x2 Streaming MAC Tile	↑ Fmax	PASS
49	Variable-Width Timestamp Delta Encoder	↓ LUT	PASS
50	Streaming Dot Product Accumulator	↑ Fmax	PASS
51	Runtime-Reconfigurable 8-Tap FIR	↓ LUT	PASS
52	Streaming 5-Point Stencil Engine	↓ LUT	PASS

Problems by Category

Category	Problems
AI/ML Accelerators	<ul style="list-style-type: none"> 4 Streaming 3x3 CNN Convolution Layer 5 Sobel Edge Detection Accelerator 12 Fixed-Point Softmax Approximation Layer 13 Hardmax One-Hot Classifier 22 Fixed-Weight Perceptron 41 64-Bin Streaming Histogram Engine 44 16x8 Binarized Dense Layer 48 2x2 Streaming MAC Tile 50 Streaming Dot Product Accumulator
Algorithmic Hardware Primitives	<ul style="list-style-type: none"> 17 Key-Value Database with Round-Robin Replacement 25 64-bit Popcount with Threshold Flag 33 Asynchronous Dual-Clock FIFO 40 Triple-Hash Bloom Filter Engine 43 Parallel Bitonic Sort and Rank Engine 45 Parallel Prefix Sum Unit 52 Streaming 5-Point Stencil Engine
Cryptography & Compression	<ul style="list-style-type: none"> 6 AES-128 Encryption Engine 7 Streaming Pipelined AES-128 Encryption 18 CRC-32 Generator 27 Streaming Run-Length Encoder 31 Hamming SECDED Decoder 49 Variable-Width Timestamp Delta Encoder
DSP & Numerical Algorithms	<ul style="list-style-type: none"> 1 4x4 Matrix Multiplier 2 16-Tap Symmetric FIR Filter 3 Pipelined 8-Tap FIR Filter 19 Iterative CORDIC Sin/Cos 20 Pipelined CORDIC Sin/Cos 29 4-Point Complex FFT 37 ECG R-Peak Detector 38 7-Sample Median Denoising Filter 51 Runtime-Reconfigurable 8-Tap FIR
Embedded Control & I/O	<ul style="list-style-type: none"> 21 Fixed-Point PID Robot Position Controller 24 Keypad Access Control FSM 26 Complementary PWM Generator with Dead-Time 28 Sliding-Window Heart-Rate Estimator 35 SPI Mode-0 Master 36 Oversampled 8N1 UART Receiver
Networking & Communications	<ul style="list-style-type: none"> 14 IPv4 Header Sniffer 15 Longest Prefix Match Router 16 Priority-Based Packet Filter 23 Streaming FIX Message Decoder 30 AXI4-Stream 8-to-32 Upsizer 34 8-Port Round-Robin Arbiter 42 Fixed-Ladder Top-of-Book Builder 46 Token Bucket Rate Limiter 47 8-Entry TCAM Lookup

Category	Problems
Soft Processors & Memory	8 G-Share Branch Predictor
	9 Dual-Port Register File
	10 8-Bit Single-Cycle ALU with Flags
	11 Direct-Mapped Write-Through Cache
	32 Priority Interrupt Controller
	39 Single-Cycle RV32I Micro Core

Category Distribution



This chart shows how the 52 benchmark problems are distributed across the benchmark categories. Each bar label includes both the problem count and the percentage of the full benchmark.