Supplementary material: Efficient Computation Discovery for Polynomial Expressions

1 RBM Partition Function Approximation

Below we give the full expressions for different terms in the Taylor series approximation of an RBM:

1.1 $\mathbf{g(x \to x^3, W)}$

We show below all generated expressions up to degree 3 (for notation clarity, we first define variables A-E).

```
A = sum(W, 2);
B = sum(W, 1);
C = sum(sum(W));
D = repmat(sum(W, 1), [n, 1]);
E = repmat(sum(W, 2), [1, m]);

C, C .^ 2, C .^ 3, sum(B .^ 2),
sum(B .^ 3), sum(A .^ 2), sum(A .^ 3)
sum(sum(B .*  E .* W))), sum(sum((W .* W)))
sum(sum(D .^ 2 .* E))
sum(B .* sum(W .* W, 1)))
C .* sum(sum((W .* W), 2))
sum(sum((E .^ 2 .* D))))
sum(A .* sum((W .* W), 2))
sum(sum(W .* W .* W)))
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Forming a linear system of these expressions and solving, we obtain the following expression for $g(x \to x^3, W)$, which is exactly equivalent to the original:

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(C .^ 3 +
C .* sum(A .^ 2) * 3 +
C .* sum(sum(W .* W, 2)) * 3 +
C .* sum(B .^ 2) * 3 +
sum(A .* sum(W .* D, 2)) * 6)) / 64;
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1.2 $\mathbf{g(x \to x^4, W)}$

For the 4th order (and subsequent terms), we only show the final expression:

2^(n+m)*(((((sum(sum(W, 2), 1) .* sum(sum(W, 2), 1)) .* (sum(sum(W, 2), 1) .* sum(sum(W, 2), 1))) .* 1) + (sum(((sum(W, 1) .* sum(W, 1)) .* (sum(W, 1) .* sum(W, 1))), 2) .* -2) + ((sum((sum(W, 1) .* sum(W, 1)), 2) .* sum((sum(W, 1) .* sum(W, 1)), 2)) .* 3) + (sum(((sum(W, 1) .* sum(W, 1)) .* sum((W .* W), 1)), 2) .* -12) + ((sum((sum(W, 1) .* sum(W, 1)), 2) .* sum(sum((W .* W), 2), 1)) .* 6) + (sum((repmat(sum(sum(W, 2), 1), [n, 1]) .* sum(((repmat(sum(W, 2), [1, m]) .* repmat(sum(W, 1), [n, 1])) .* W), 2)), 1) .* 24) + (((sum(sum(W, 2), 1) .* sum(sum(W, 2), 1)) .* sum((sum(W, 1) .* sum(W, 1)), 2)) .* 6) + (sum(((sum(W, 2) .* sum(W, 2)) .* (sum(W, 2) .* sum(W, 2))), 1) .* -2) + ((sum((sum(W, 2) .* sum(W, 2)), 1) .* sum((sum(W, 2) .* sum(W, 2)), 1)) .* 3) + (((sum(W, 2)') * ((W * (W')) * sum(W, 2))) .* 12) + (((sum(W, 1) * (W')) * (W * (sum(W, 1)'))) .* 12) + (((sum(sum(W, 2), 1) .* sum(sum(W, 2), 1)) .* sum((sum(W, 2) .* sum(W, 2)), 1)) .* 6) + (sum(((sum(W, 2) .* sum(W, 2)) .* sum((W .* W), 2)), 1) .* -12) + ((sum((sum(W, 1) .* sum(W, 1)), 2) .* sum((sum(W, 2) .* sum(W, 2)), 1)) .* 6) + (sum(sum(((W .* W) .* (W .* W)), 2), 1) .* 4) + (((sum(sum(W, 2), 1) .* sum(sum(W, 2), 1)) .* sum(sum((W .* W), 2), 1)) .* 6) + ((sum((sum(W, 2) .* sum(W, 2)), 1) .* sum(sum((W .* W), 2), 1)) .* 6) + ((sum(sum((W .* W), 2), 1) .* sum(sum((W .* W), 2), 1)) .* 3) + (sum((sum((W .* W), 1) .* sum((W .* W), 1)), 2) .* -6) + (sum((sum((W .* W), 2) .* sum((W .* W), 2)), 1) .* -6) + (sum(sum(((W * (W')) .* (W * (W'))), 1), 2) .* 6))) / 256;

1.3 $\mathbf{g(x \to x^5, W)}$

2^(n+m)*(((sum(sum((repmat((sum(W, 1) .* sum(W, 1)), [n, 1]) .* ((repmat(sum(W, 2), [1, m]) .* repmat(sum(W, 1), [n, 1])) .* W)), 2), 1) .* -40) + (sum(((sum(W, 1) .* sum(W, 1)) .* sum((repmat(sum(W, 1), [n, 1]) .* (repmat(sum(W, 2), [1, m]) .* repmat(sum(W, 1), [n, 1]))), 1)), 2) .* -10) + ((sum(sum(W, 2), 1) .* sum(((sum(W, 2) .* sum(W, 2)) .* sum((W .* W), 2)), 1)) .*

-60) + (sum((repmat(sum(sum(W, 2), 1), [n, 1]) .* (repmat(sum(sum(W, 2), 1), [n, 1]) .* sum(((repmat(sum(W, 2), [1, m]) .* repmat(sum(W, 1), [n, 1])) .* W), 2))), 1) .* 60) + (sum((sum((W .* repmat(sum(W, 1), [n, 1])), 2) .* sum((repmat(sum(W, 1), [n, 1]) .* (repmat(sum(W, 2), [1, m]) .* repmat(sum(W, 1), [n, 1]))), 2)), 1) .* 60) + (sum(sum(((repmat(sum(W, 2), [1, m]) .* repmat(sum(W, 1), [n, 1])) .* (W .* (W .* W))), 2), 1) .* 80) + (sum((sum(W, 2) .* (sum(W, 2) .* sum(((repmat(sum(W, 2), [1, m]) .* repmat(sum(W, 1), [n, 1])) .* W), 2))), 1) .* -40) + (sum((repmat(sum((sum(W, 2) .* sum(W, 2)), 1), [n, 1]) .* sum(((repmat(sum(W, 2), [1, m]) .* repmat(sum(W, 1), [n, 1])) .* W), 2)), 1) .* 60) + (((sum(W, 1) * (W')) * ((W * (W')) * sum(W, 2))) .* 120) + (sum(((sum(W, 2) .* sum(W, 2)) .* sum((repmat(sum(W, 2), [1, m]) .* (repmat(sum(W, 2), [1, m]) .* repmat(sum(W, 1), [n, 1]))), 2)), 1) .* -10) + ((sum(sum(W, 2), 1) .* sum(((sum(W, 1) .* sum(W, 1)) .* sum((W .* W), 1)), 2)) .* -60) + (sum((sum(repmat((sum(W, 2) .* sum(W, 2)), [1, m]), 1) .* sum((repmat(sum(W, 2), [1, m]) .* (repmat(sum(W, 2), [1, m]) .* repmat(sum(W, 1), [n, 1]))), 1)), 2) .* 15) + (((sum(sum(W, 2), 1) * (sum(W, 2)')) * ((W * (W')) * sum(W, 2))) .* 60) + (((sum(sum(W, 2), 1) * (sum(W, 1) * (W'))) * (W * (sum(W, 1)'))) .* 60) + ((sum(sum(W, 2), 1) .* (sum((sum(W, 1) .* sum(W, 1)), 2) .* sum((sum(W, 1) .* sum(W, 1)), 2))) .* 15) + ((sum(sum(W, 2), 1) .* ((sum(sum(W, 2), 1) .* sum(sum(W, 2), 1)) .* (sum(sum(W, 2), 1) .* sum(sum(W, 2), 1)))) .* 1) + ((sum((sum(W, 1) .* sum(W, 1)), 2) .* (sum(sum(W, 2), 1) .* (sum(sum(W, 2), 1) .* sum(sum(W, 2), 1)))) .* 10) + (sum((sum(((repmat(sum(W, 2), [1, m]) .* repmat(sum(W, 1), [n, 1])) .* W), 2) .* repmat(sum(sum((W .* W), 2), 1), [n, 1])), 1) .* 60) + ((sum((sum(W, 2) .* sum(W, 2)), 1) .* (sum(sum(W, 2), 1) .* (sum(sum(W, 2), 1) .* sum(sum(W, 2), 1)))) .* 10) + ((sum(sum((W .* W), 2), 1) .* (sum(sum(W, 2), 1) .* (sum(sum(W, 2), 1) .* sum(sum(W, 2), 1)))) .* 10) + (sum((sum(repmat((sum(W, 1) .* sum(W, 1)), [n, 1]), 2) .* sum((repmat(sum(W, 2), [1, m]) .* (repmat(sum(W, 2), [1, m]) .* repmat(sum(W, 1), [n, 1]))), 2)), 1) .* 30) + (sum(sum((((repmat(sum(W, 2), [1, m]) .* repmat(sum(W, 1), [n, 1])) .* W) .* repmat(sum((W .* W), 1), [n, 1])), 2), 1) .* -120) + ((sum(sum(W, 2), 1) .* (sum((sum(W, 1) .* sum(W, 1)), 2) .* sum(sum((W .* W), 2), 1))) .* 30) + (sum(sum(((repmat(sum(W, 2), [1, m]) .* repmat(sum((W .* W), 1), [n, 1])) .* repmat(sum((W .* W), 1), [n, 1])), 2), 1) .* -30) + ((sum(sum(W, 2), 1) .* (sum((sum(W, 2) .* sum(W, 2)), 1) .* sum(sum((W .* W), 2), 1))) .* 30) + (sum((repmat(sum(sum(W, 2), 1), [n, 1]) .* (sum((W .* W), 2) .* sum((W .* W), 2))), 1) .* -30) + (sum((repmat(sum(sum(W, 2), 1), [n, 1]) .* sum(((W .* W) .* (W .* W)), 2)), 1) .* 20) + ((sum(sum(W, 2), 1) .* (sum(sum((W .* W), 2), 1) .* sum(sum((W .* W), 2), 1))) .* 15) + (sum((sum((W .* W), 2) .* sum(((repmat(sum(W, 2), [1, m]) .* repmat(sum(W, 1), [n, 1])) .* W), 2)), 1) .* -120) + (sum((((W * (W')) .* (W * (W'))) * repmat(sum(sum(W, 2), 1), [n, 1])), 1) .* 30))) / 1024;

1.4 $\mathbf{g(x \rightarrow x^6, W)}$

2^(n+m)*(((sum(sum(((W .* W) .* ((repmat(sum(W, 2), [1, m]) .* repmat(sum(W, 1), [n, 1])) .* (repmat(sum(W, 2), [1, m]) .* repmat(sum(W, 1), [n, 1])))), 2), 1) .* 360) + (sum(sum(((W .* repmat(sum(W, 2), [1, m])) .* ((W .* repmat(sum(W, 2), [1, m])) .* repmat(sum((W .* W), 1), [n, 1]))), 2), 1) .* 360) + (sum(((sum(W, 1) .* sum(W, 1)) .* ((sum(W, 1) .* sum(W, 1)) .* (sum(W, 1) .* sum(W, 1)))), 2) .* 16) + ((sum((sum(W, 1) .* sum(W, 1)), 2) .* sum(((sum(W, 1) .* sum(W, 1)) .* (sum(W, 1) .* sum(W, 1))), 2)) .* -30) + (((sum(W, 1) * ((W') * sum(W, 2))) * (sum(W, 1) * ((W') * sum(W, 2)))) .* 360) + (((sum(W, 1) * (W')) * ((W .* (W .* W)) * (sum(W, 1)'))) .* 480) + (sum(((sum(W, 2) .* sum(W, 2)) .* ((sum(W, 2) .* sum(W, 2)) .* (sum(W, 2) .* sum(W, 2)))), 1) .* 16) + (sum(sum(((W .* repmat(sum(W, 1), [n, 1])) .* ((W .* repmat(sum(W, 1), [n, 1])) .* repmat(sum((W .* W), 2), [1, m]))), 2), 1) .* 360) + ((sum((sum(W, 1) .* sum(W, 1)), 2) .* sum(((sum(W, 1) .* sum(W, 1)) .* sum((W .* W), 1)), 2)) .* -180) + (sum((repmat(sum(sum(W, 2), 1), [n, 1]) .* sum(((repmat(sum(W, 2), [1, m]) .* repmat(sum(W, 1), [n, 1])) .* (W .* (W .* W))), 2)), 1) .* 480) + (sum((repmat(sum(sum(W, 2), 1), [n, 1]) .* (sum(W, 2) .* (sum(W, 2) .* sum(((repmat(sum(W, 2), [1, m]) .* repmat(sum(W, 1), [n, 1])) .* W), 2)))), 1) .* -240) + (sum((sum((W .* repmat(sum(W, 1), [n, 1])), 2) .* (sum(W, 2) .* sum(repmat(sum((repmat(sum(W, 2), [1, m]) .* (repmat(sum(W, 2), [1, m]) .* repmat(sum(W, 1), [n, 1]))), 1), [n, 1]), 2))), 1) .* 360) + (((sum(sum(W, 2), 1) * (sum(W, 1) * (W'))) * ((W * (W')) * sum(W, 2))) .* 720) + (((sum(sum(W, 2), 1) .* sum(sum(W, 2), 1)) .* ((sum(sum(W, 2), 1) .* sum(sum(W, 2), 1)) .* (sum(sum(W, 2), 1) .* sum(sum(W, 2), 1)))) .* 1) + ((sum((sum(W, 1) .* sum(W, 1)), 2) .* ((sum(sum(W, 2), 1) .* sum(sum(W, 2), 1)) .* (sum(sum(W, 2), 1) .* sum(sum(W, 2), 1)))) .* 15) + (sum((sum((W .* repmat(sum(W, 1), [n, 1])), 2) .* (sum(W, 2) .* repmat((sum(sum(W, 2), 1) .* (sum(sum(W, 2), 1) .* sum(sum(W, 2), 1))), [n, 1]))), 1) .* 120) + ((sum((sum(W, 2) .* sum(W, 2)), 1) .* ((sum(sum(W, 2), 1) .* sum(sum(W, 2), 1)) .* (sum(sum(W, 2), 1) .* sum(sum(W, 2), 1)))) .* 15) + ((sum(sum((W .* W), 2), 1) .* ((sum(sum(W, 2), 1) .* sum(sum(W, 2), 1)) .* (sum(sum(W, 2), 1) .* sum(sum(W, 2), 1)))) .* 15) + (sum(sum((repmat((sum(W, 2) .* sum(W, 2)), [1, m]) .* ((repmat(sum(W, 2), [1, m]) .* repmat(sum(W, 1), [n, 1])) .* (repmat(sum(W, 2), [1, m]) .* repmat(sum(W, 1), [n, 1])))), 1), 2) .* -30) + (sum((sum((repmat(sum(W, 2), [1, m]) .* (repmat(sum(W, 2), [1, m]) .* repmat(sum(W, 1), [n, 1]))), 1) .* sum((repmat(sum(W, 2), [1, m]) .* (repmat(sum(W, 2), [1, m]) .* repmat(sum(W, 1), [n, 1]))), 1)), 2) .* 45) + (sum((sum((W .* repmat(sum(W, 2), [1, m])), 1) .* (sum((W .* repmat(sum(W, 2), [1, m])), 1) .* repmat(sum((sum(W, 1) .* sum(W, 1)), 2), [1, m]))), 2) .* 180) + (sum((sum((W .* repmat(sum(W, 2), [1, m])), 1) .* (sum(W, 1) .* sum(((repmat(sum(W, 2), [1, m]) .* repmat(sum(W, 1), [n, 1])) .* W), 1))), 2) .* -360) + ((sum((sum(W, 1) .* sum(W, 1)), 2) .* (sum((sum(W, 1) .* sum(W, 1)), 2) .* sum((sum(W, 1) .* sum(W, 1)), 2))) .* 15) + (sum((sum((repmat(sum(W, 1), [n, 1]) .* (repmat(sum(W, 2), [1, m]) .* repmat(sum(W, 1), [n, 1]))), 1) .* sum((repmat(sum(W, 1), [n, 1]) .* (repmat(sum(W, 2), [1, m]) .* repmat(sum(W, 1), [n, 1]))), 1)), 2) .* -30) + ((sum(sum(W, 2), 1) .* (sum(sum(W, 2), 1) .* (sum((sum(W, 1) .* sum(W, 1)), 2) .* sum((sum(W, 1) .* sum(W, 1)), 2)))) .* 45) + (((sum(W, 1) .* sum(W, 1)) * ((repmat(sum(W, 1), [m, 1]) * (W')) * (W * (sum(W, 1)')))) .* 180) + (sum((sum((W .* repmat(sum(W, 1), [n, 1])), 2) .* ((sum(W, 2) .* repmat(sum(sum(W, 2), 1), [n, 1])) .* sum(repmat((sum(W, 1) .* sum(W, 1)), [n, 1]), 2))), 1) .* 360) + ((sum((W .* W), 1) * (((W') * sum(W, 2)) .* ((W') * sum(W, 2)))) .* -360) + (sum((sum((W .* W), 1) .* ((sum(W, 1) .* sum(W, 1)) .* (sum(W, 1) .* sum(W, 1)))), 2) .* 240) + ((sum(sum((W .* W), 2), 1) .* sum(((sum(W, 1) .* sum(W, 1)) .* (sum(W, 1) .* sum(W, 1))), 2)) .* -30) + ((sum((sum(W, 1) .* sum(W, 1)), 2) .* (sum((sum(W, 1) .* sum(W, 1)), 2) .* sum(sum((W .* W), 2), 1))) .* 45) + ((sum(sum(W, 2), 1) .* (sum(sum(W, 2), 1) .* sum(((sum(W, 1) .* sum(W, 1)) .* sum((W .* W), 1)), 2))) .* -180) + (((sum(sum(W, 2), 1) .* sum(sum(W, 2), 1)) .* (sum((sum(W, 1) .* sum(W, 1)), 2) .* sum(sum((W .* W), 2), 1))) .* 90) + (sum(sum(((repmat(sum((W .* W), 2), [1, m]) .* repmat(sum((W .* W), 1), [n, 1])) .* (W .* W)), 2), 1) .* 360) + (sum((sum((W .* W), 1) .* (sum((W .* W), 1) .* repmat(sum((sum(W, 1) .* sum(W, 1)), 2), [1, m]))), 2) .* -90) + ((sum(sum((W .* W), 2), 1) .* sum(((sum(W, 2) .* sum(W, 2)) .* (sum(W, 2) .* sum(W, 2))), 1)) .* -30) + ((sum((sum(W, 2) .* sum(W, 2)), 1) .* (sum((sum(W, 2) .* sum(W, 2)), 1) .* sum(sum((W .* W), 2), 1))) .* 45) + (sum((sum((W .* repmat(sum(W, 2), [1, m])), 1) .* (sum((W .* repmat(sum(W, 2), [1, m])), 1) .* repmat(sum(sum((W .* W), 2), 1), [1, m]))), 2) .* 180) + (sum((sum((W .* repmat(sum(W, 1), [n, 1])), 2) .* (sum((W .* repmat(sum(W, 1), [n, 1])), 2) .* repmat(sum(sum((W .* W), 2), 1), [n, 1]))), 1) .* 180) + (sum(((sum(W, 2) .* repmat(sum(sum(W, 2), 1), [n, 1])) .* (sum((W .* repmat(sum(W, 1), [n, 1])), 2) .* repmat(sum(sum((W .* W), 2), 1), [n, 1]))), 1) .* 360) + (sum((sum((W .* repmat(sum(W, 1), [n, 1])), 2) .* sum((repmat((sum(W, 1) .* sum(W, 1)), [n, 1]) .* (W .* repmat(sum(W, 1), [n, 1]))), 2)), 1) .* -240) + (sum(sum((W .* repmat((repmat(sum(sum(W, 2), 1), [1, m]) .* (sum(W, 1) .* sum(((repmat(sum(W, 2), [1, m]) .* repmat(sum(W, 1), [n, 1])) .* W), 1))), [n, 1])), 2), 1) .* -240) + ((sum((sum(W, 2) .* sum(W, 2)), 1) .* sum(((sum(W, 1) .* sum(W, 1)) .* (sum(W, 1) .* sum(W, 1))), 2)) .* -30) + (((sum(sum(W, 2), 1) .* sum(sum(W, 2), 1)) .* sum(((sum(W, 2) .* sum(W, 2)) .* sum((W .* W), 2)), 1)) .* -180) + (((sum(sum(W, 2), 1) .* sum(sum(W, 2), 1)) .* sum(sum(((W .* W) .* (W .* W)), 2), 1)) .* 60) + (sum((sum((repmat(sum(W, 2), [1, m]) .* (repmat(sum(W, 2), [1, m]) .* repmat(sum(W, 1), [n, 1]))), 2) .* sum((repmat(sum(W, 2), [1, m]) .* (repmat(sum(W, 2), [1, m]) .* repmat(sum(W, 1), [n, 1]))), 2)), 1) .* -30) + ((sum(sum(W, 2), 1) .* sum((sum(repmat((sum(W, 2) .* sum(W, 2)), [1, m]), 1) .* sum((repmat(sum(W, 2), [1, m]) .* (repmat(sum(W, 2), [1, m]) .* repmat(sum(W, 1), [n, 1]))), 1)), 2)) .* 45) + (sum((sum((W .* repmat(sum(W, 2), [1, m])), 1) .* (sum((W .* repmat(sum(W, 2), [1, m])), 1) .* repmat((sum(sum(W, 2), 1) .* sum(sum(W, 2), 1)), [1, m]))), 2) .* 180) + (((sum(sum(W, 2), 1) .* sum(sum(W, 2), 1)) .* (sum((sum(W, 1) .* sum(W, 1)), 2) .* sum((sum(W, 2) .* sum(W, 2)), 1))) .* 90) + (sum((sum((W .* repmat(sum(W, 1), [n, 1])), 2) .* (sum((W .* repmat(sum(W, 1), [n, 1])), 2) .* repmat((sum(sum(W, 2), 1) .* sum(sum(W, 2), 1)), [n, 1]))), 1) .* 180) + (((sum(W, 1) * ((W') * W)) * (((W') * W) * (sum(W, 1)'))) .* 360) + (sum((sum((W .* repmat(sum(W, 1), [n, 1])), 2) .* (sum((W .* repmat(sum(W, 1), [n, 1])), 2) .* repmat(sum((sum(W, 2) .* sum(W, 2)), 1), [n, 1]))), 1) .* 180) + ((sum((sum(W, 1) .* sum(W, 1)), 2) .* (sum((sum(W, 1) .* sum(W, 1)), 2) .* sum((sum(W, 2) .* sum(W, 2)), 1))) .* 45) + ((((sum(W, 2)') * W) * (((W') * W) * ((W') * sum(W, 2)))) .* 360) + (sum((sum((W .* repmat(sum(W, 2), [1, m])), 1) .* sum((repmat((sum(W, 2) .* sum(W, 2)), [1, m]) .* (W .* repmat(sum(W, 2), [1, m]))), 1)), 2) .* -240) + ((((sum(W, 2)') * W) * ((W') * (repmat(sum(W, 2), [1, n]) * (sum(W, 2) .* sum(W, 2))))) .* 180) + ((((sum(W, 2)') * W) * (((W .* (W .* W))') * sum(W, 2))) .* 480) + ((sum((sum(W, 2) .* sum(W, 2)), 1) .* sum(((sum(W, 2) .* sum(W, 2)) .* (sum(W, 2) .* sum(W, 2))), 1)) .* -30) + ((sum((sum(W, 2) .* sum(W, 2)), 1) .* (sum((sum(W, 2) .* sum(W, 2)), 1) .* sum((sum(W,

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2) .* sum(W, 2)), 1))) .* 15) + ((sum(( sum(W, 2) .*
sum(W, 2)), 1) .* sum(( ( sum(W, 2) .* sum(W, 2)) .*
sum(( W .* W), 2)), 1)) .* -180) + (sum((( sum(( W .*
W), 2) .* sum(( W .* W), 2)) .* repmat(sum(( sum(W,
2) .* sum(W, 2)), 1), [n, 1])), 1) .* -90) + ((sum((
sum(W, 1) .* sum(W, 1)), 2) .* ( sum(( sum(W, 2) .*
sum(W, 2)), 1) .* sum(sum(( W .* W), 2), 1))) .* 90)
+ ( sum(( ( sum(W, 1) .* sum(W, 1)) .* sum(( ( W .*
W) .* ( W .* W)), 1)), 2) .* -480) + (( sum(( sum(W,
1) .* sum(W, 1)), 2) .* sum(sum(( ( W .* W) .* ( W
.* W)), 2), 1)) .* 60) + ( sum(( sum(( W .* W), 1)
.* sum(( ( W .* W) .* ( W .* W)), 1)), 2) .* -480)
+ (sum((sum(repmat(( sum(W, 2) .* sum(W, 2)), [1,
m]), 1) .* sum(( ( W .* W) .* ( W .* W)), 1)), 2) .*
60) + ( ( ( sum(W, 1) .* sum(( W .* W), 1)) * ( (
(W') * W) * (sum(W, 1)'))) .* -720) + ((sum(sum(W,
2), 1) .* sum(sum((( ( repmat(sum(W, 2), [1, m]) .*
repmat(sum(W, 1), [n, 1])) .* W) .* repmat(sum(( W
.* W), 1), [n, 1])), 2), 1)) .* -720) + ((sum(( sum(W,
2) .* sum(W, 2)), 1) .* sum(( ( sum(W, 1) .* sum(W,
1)) .* sum(( W .* W), 1)), 2)) .* -180) + ((sum(sum((
W .* W), 2), 1) .* sum(( ( sum(W, 1) .* sum(W, 1)) .*
sum(( W .* W), 1)), 2)) .* -180) + (sum(( ( sum(W,
1) .* sum(W, 1)) .* ( sum(( W .* W), 1) .* sum(( W
.* W), 1))), 2) .* 720) + ( sum(( sum(( W .* W), 1)
.* ( sum(( W .* W), 1) .* sum(( W .* W), 1))), 2)
.* 240) + (sum(sum((repmat(sum(( W .* W), 1), [n,
1]) .* (repmat(( sum(W, 2) .* repmat(sum(sum(W, 2),
1), [n, 1])), [1, m]) .* repmat(sum(( W .* W), 1), [n,
1]))), 2), 1) .* -90) + (sum((sum(repmat(( sum(W, 2)
.* sum(W, 2)), [1, m]), 1) .* ( sum(( W .* W), 1) .*
sum(( W .* W), 1))), 2) .* -90) + (sum((sum(( W .*
W), 2) .* ( sum(( W .* W), 2) .* repmat(( sum(sum(W,
2), 1) .* sum(sum(W, 2), 1)), [n, 1]))), 1) .* -90) +
((sum(( sum(W, 1) .* sum(W, 1)), 2) .* ( sum(sum((
W .* W), 2), 1) .* sum(sum(( W .* W), 2), 1))) .* 45)
+ ((( sum(sum(W, 2), 1) .* sum(sum(W, 2), 1)) .* (
sum(sum(( W .* W), 2), 1) .* sum(sum(( W .* W), 2),
1))) .* 45) + ((( sum(sum(W, 2), 1) .* sum(sum(W,
2), 1)) .* ( sum(( sum(W, 2) .* sum(W, 2)), 1) .*
sum(sum(( W .* W), 2), 1))) .* 90) + (sum(( sum(( W
.* W), 2) .* ( ( sum(W, 2) .* sum(W, 2)) .* ( sum(W,
2) .* sum(W, 2)))), 1) .* 240) + ( sum(( ( sum(W, 2)
.* sum(W, 2)) .* sum(( ( W .* W) .* ( W .* W)), 2)),
1) .* -480) + (sum(( ( sum(W, 2) .* sum(W, 2)) .* (
sum(( W .* W), 2) .* sum(( W .* W), 2))), 1) .* 720)
+ ((sum(sum(W, 2), 1) .* sum((sum(( W .* W), 2) .*
sum(( ( repmat(sum(W, 2), [1, m]) .* repmat(sum(W,
1), [n, 1])) .* W), 2)), 1)) .* -720) + ( ( ( (sum(W, 2)')
* ( W * (W'))) * ( sum(W, 2) .* sum(( W .* W), 2)))
.* -720) + ( sum(( sum(( W .* W), 2) .* sum(( ( W
.* W) .* ( W .* W)), 2)), 1) .* -480) + ( sum(( sum((
W .* W), 2) .* ( sum(( W .* W), 2) .* sum(( W .*
W), 2))), 1) .* 240) + ((sum(( sum(W, 1) .* sum(W,
1)), 2) .* sum(( ( sum(W, 2) .* sum(W, 2)) .* sum((
W .* W), 2)), 1)) .* -180) + ((sum(sum(( W .* W),
2), 1) .* sum(( ( sum(W, 2) .* sum(W, 2)) .* sum((
W .* W), 2)), 1)) .* -180) + (sum((sum(( W .* rep-
mat(sum(W, 1), [n, 1])), 2) .* (sum(W, 2) .* sum(( (
repmat(sum(W, 2), [1, m]) .* repmat(sum(W, 1), [n,
1])) .* W), 2))), 1) .* -360) + ( ( ( ( sum(W, 1) *
(W')) .* ( sum(W, 1) * (W'))) * sum(( W .* W), 2))
.* -360) + (sum((sum(repmat(( sum(W, 1) .* sum(W,
1)), [n, 1]), 2) .* ( sum(( W .* W), 2) .* sum(( W .*
W), 2))), 1) .* -90) + ((sum(( sum(W, 2) .* sum(W,
2)), 1) .* ( sum(sum(( W .* W), 2), 1) .* sum(sum((
W .* W), 2), 1))) .* 45) + ( sum(sum(( ( W .* W)
.* ( ( W .* W) .* ( W .* W))), 2), 1) .* 256) + ( (
sum(sum(( W .* W), 2), 1) .* sum(sum(( ( W .* W)
.* ( W .* W)), 2), 1)) .* 60) + ((sum(sum(( W .* W),
2), 1) .* ( sum(sum(( W .* W), 2), 1) .* sum(sum((
W .* W), 2), 1))) .* 15) + (sum(sum((repmat(sum((
W .* W), 1), [n, 1]) .* ( repmat(sum(( W .* W), 2),
[1, m]) .* repmat(sum(( W .* W), 1), [n, 1]))), 1), 2)
.* -90) + ((repmat(sum(sum(W, 2), 1), [1, m]) * ( (
( (W') * W) .* ( (W') * W)) * repmat(sum(sum(W,
2), 1), [m, 1]))) .* 90) + (sum(sum((repmat(sum(( W
.* W), 2), [1, m]) .* ( repmat(sum(( W .* W), 2), [1,
m]) .* repmat(sum(( W .* W), 1), [n, 1]))), 2), 1) .*
-90) + ( sum(( ( ( W * (W')) .* ( W * (W'))) * (
sum(W, 2) .* sum(W, 2))), 1) .* -360) + ( sum(( ( (
W * (W')) .* ( W * (W'))) * sum(( W .* W), 2)), 1)
.* -360) + (sum(( ( ( W * (W')) .* ( W * (W'))) *
sum(repmat(( sum(W, 1) .* sum(W, 1)), [n, 1]), 2)),
1) .* 90) + (sum(( ( ( W * (W')) .* ( W * (W'))) *
repmat(sum(( sum(W, 2) .* sum(W, 2)), 1), [n, 1])),
1) .* 90) + ( sum(( ( sum(W, 1) .* sum(W, 1)) * (
( (W') * W) .* ( (W') * W))), 2) .* -360) + ( sum((
sum(( W .* W), 1) * ( ( (W') * W) .* ( (W') * W))),
2) .* -360) + (( repmat(sum(sum(( W .* W), 2), 1),
[1, m]) * sum(( ( (W') * W) .* ( (W') * W)), 2)) .*
90) + ( sum(sum(( W .* ( ( W * (W')) * ( W .* ( W
.* W)))), 2), 1) .* 480) + ( sum(sum(( ( ( W * (W'))
* W) .* ( ( W * (W')) * W)), 2), 1) .* 120))) / 4096;
```