

⇒ Fill in the + and - symbols in these charts for the 4 *target* expressions in the matrix product—these are the ones we need for our final answer:

$(ae) + (bg)$:

	e	f	g	h
a	+			
b			+	
c				
d				

$(af) + (bh)$:

	e	f	g	h
a		+		
b				+
c				
d				

$(ce) + (dg)$:

	e	f	g	h
a				
b				
c	+			
d			+	

$(cf) + (dh)$:

	e	f	g	h
a				
b				
c		+		
d				+

⇒ Now fill in the symbols for the three key products figured out by Strassen, namely m_1 , m_2 , and m_3 :

$$m_1 = (a + d)(e + h) :$$

$$ae + ah + de + dh$$

	e	f	g	h
a	+			+
b				
c				
d	+			+

$$m_2 = (c - a)(e + f) :$$

$$ce + cf - ae - af$$

	e	f	g	h
a	-	-		
b				
c	+	+		
d				

$$m_3 = (b - d)(g + h) :$$

$$bg + bh - dg - dh$$

	e	f	g	h
a				
b			+	+
c				
d			-	-

⇒ Fill in the symbols for these two suggested sums:

$m_1 + m_2$:

"Say we want to get rid of these two" → $e(c+d)$

	e	f	g	h
a	+	-		+
b				
c	+	+		
d	+			+

$m_1 + m_3$:

targets →

	e	f	g	h
a	+			+
b			+	+
c				
d	+		-	-

"how do we get rid of extraneous things?"

(hint: do $m_4 \dots m_7$ to get patterns to add or subtract from $m_1 + m_3$, $m_1 + m_2$ to get diagonal targets. Then, turns out, can combine some of these 7 charts to get off-diagonal targets)

Exercise 9

$$\begin{bmatrix} 5 & 7 \\ 4 & 2 \end{bmatrix} \cdot \begin{bmatrix} 9 & 1 \\ 3 & 6 \end{bmatrix}$$

$$m_1 = (5+2)(9+6) = 7 \cdot 15 = 105$$

$$m_2 = (4+2) \cdot 9 = 54$$

$$m_3 = 5 \cdot (1-6) = -25$$

$$m_4 = 2(3-9) = -12$$

$$m_5 = (5+7)6 = 72$$

$$m_6 = (4-5)(9+1) = -10$$

$$m_7 = (7-2)(3+6) = 45$$

$$= \begin{array}{c|c} c_{11} = m_1 + m_4 - m_5 + m_7 & c_{12} = m_3 + m_5 \\ \hline c_{21} = m_2 + m_4 & c_{22} = m_1 - m_2 + m_3 + m_5 \end{array}$$

$$= \begin{array}{c|c} 66 & 47 \\ \hline 42 & 16 \end{array}$$