Figure 13.1 A recursive 8-point unordered FFT computation.
Figure 13.2 The pattern of combination of elements of the input and the intermediate sequences during a 16-point unordered FFT computation.
Figure 13.3  A 16-point unordered FFT on 16 processes. $P_i$ denotes the process labeled $i$. 
Figure 13.4  A 16-point FFT on four processes. $P_i$ denotes the process labeled $i$. In general, the number of processes is $p = 2^d$ and the length of the input sequence is $n = 2^r$. 

\[ m = 0 \quad m = 1 \quad m = 2 \quad m = 3 \]

\begin{align*}
0000 & \quad X[0] & \quad Y[0] \\
0001 & \quad X[1] & \quad Y[1] \\
0111 & \quad X[7] & \quad Y[7] \\
1000 & \quad X[8] & \quad Y[8] \\
1001 & \quad X[9] & \quad Y[9] \\
1010 & \quad X[10] & \quad Y[10] \\
1100 & \quad X[12] & \quad Y[12] \\
1110 & \quad X[14] & \quad Y[14] \\
1111 & \quad X[15] & \quad Y[15]
\end{align*}
Figure 13.5  Isoefficiency functions of the binary-exchange algorithm on a hypercube with $t_c = 2$, $t_w = 4$, and $t_s = 25$ for various values of $E$. 
Figure 13.6 The efficiency of the binary-exchange algorithm as a function of $n$ on a 256-node hypercube with $t_c = 2$, $t_w = 4$, and $t_s = 25$. 
Figure 13.7  Data communication during an FFT computation on a logical square mesh of 64 processes. The figure shows all the processes with which the processes labeled 0 and 37 exchange data.
Figure 13.8  The pattern of combination of elements in a 16-point FFT when the data are arranged in a $4 \times 4$ two-dimensional square array.
Figure 13.9  The two-dimensional transpose algorithm for a 16-point FFT on four processes.
Figure 13.10  Data distribution in the three-dimensional transpose algorithm for an $n$-point FFT on $p$ processes ($\sqrt{p} \leq n^{1/3}$).
Figure 13.11 The communication (transposition) phases in the three-dimensional transpose algorithm for an $n$-point FFT on $p$ processes.

(a) Transpose in the $i^{th}$ column of processors during phase 2
(b) Transpose in the $i^{th}$ row of processors during phase 4
Figure 13.12  A comparison of the speedups obtained by the binary-exchange, 2-D transpose, and
3-D transpose algorithms on a 64-node hypercube with $t_c = 2$, $t_w = 4$, and $t_s = 25$. 