| Bit (left to right) | Meaning if bit set to 1 |
|---|---|
| CWR | Congestion window was reduced for ECE |
| ECE | ECN was detected on incoming segment |
| URG | Urgent pointer field is valid |
| ACK | Acknowledgement field is valid |
| PSH | This segment requests a push |
| RST | Reset the connection |
| SYN | Synchronize sequence numbers |
| FIN | Sender has reached end of its byte stream |

**Figure 11.8**  Bits of the CODE BITS field in the TCP header.

## 11.12 Out Of Band Data

Although TCP is a stream-oriented protocol, it is sometimes important for the program at one end of a connection to send data *out of band*, without waiting for the program at the other end of the connection to consume octets already in the stream. For example, when TCP is used for a remote desktop application, the user may decide to send a keyboard sequence that *interrupts* or *aborts* the currently running program. Such signals are most often needed when an application on the remote machine freezes and fails to respond to mouse clicks or normal keystrokes. The interrupt signal must be sent without waiting for the remote program to read octets already in the TCP stream (or one would not be able to abort programs that stop reading input).

To accommodate out-of-band signaling, TCP allows the sender to specify data as *urgent*, meaning that the receiving application should be notified of its arrival as quickly as possible, regardless of its position in the stream. The protocol specifies that when urgent data is found, the receiving TCP should notify the application program associated with the connection to go into "urgent mode." After all urgent data has been consumed, TCP tells the application program to return to normal operation.

The exact details of how TCP informs an application about urgent data depend on the computer's operating system. The mechanism used to mark urgent data when transmitting it in a segment consists of the URG code bit and the *URGENT POINTER* field in the segment header. When the URG bit is set, the *URGENT POINTER* field specifies the position in the segment where urgent data ends.

## 11.13 TCP Options

As Figure 11.7 indicates, a TCP header can contain zero or more *options*; the next sections explain the available options. Each option begins with a 1-octet field that specifies the option *type* followed by a 1-octet length field that specifies the size of the option in octets. Recall that the header length is specified in 32-bit multiples. If the