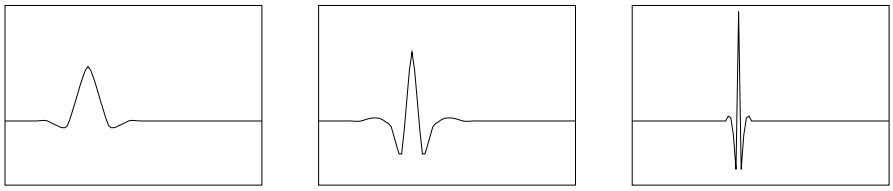

Figure A.3: Graphs of 9,7-biorthogonal wavelets on 100 points. Left: index 32, level 3. Middle: index 36, level 4. Right: index 41, level 5.

WS Lifting: 9,7-Biorthogonal Discrete Wavelet Transform

```
wsl97dwt( u[], N, dq, J ):
[0] If J>0, then do [1] to [2]
[1]    Compute wsl97filter( u[], N, dq )
[2]    Compute wsl97dwt( u[], N, 2*dq, J-1 )
```

The inverse filter transform requires one normalization, two updatings, and two predictions, with inverted coefficients:

WS Lifting: Inverse 9,7-Biorthogonal Filter Transform

```
wsl97ifilter( u[], N, dq ):
[0] Compute lnormalize( u[], N, dq, 1/zeta97 )
[1] Compute wslupdate( u[], N, dq, -delta97 )
[2] Compute wslpredict( u[], N, dq, -gamma97 )
[3] Compute wslupdate( u[], N, dq, -beta97 )
[4] Compute wslpredict( u[], N, dq, -alpha97 )
```

Reconstruction from the output coefficients is accomplished by the inverse:

WS Lifting: 9,7-Biorthogonal Inverse Wavelet Transform

```
wsl97idwt( u[], N, dq, J ):
[0] If J>0, then do [1] to [2]
[1]    Compute wsl97idwt( u[], N, 2*dq, J-1 )
[2]    Compute wsl97ifilter( u[], N, dq )
```

To plot the requested wavelets, we create three arrays u_0, u_1, u_2 of 100 locations each. We put zeroes everywhere except for $u_0(32) = 1$, $u_1(36) = 1$, and $u_2(41) = 1$, then call `wsl97idwt(u0,100,1,3)`, `wsl97idwt(u1,100,1,4)`, and `wsl97idwt(u2,100,1,5)`. The piecewise linear functions through the three resulting sequences $\{(k, u_i(k)) : 0 \le k < 100\}$, $i = 1, 2, 3$, are plotted in Figure A.3. □

20. **Solution:** First implement half-sample symmetric prediction and updating, by modifying `wslpredict()` and `wslupdate()`: