Algorithm 1 Unsupervised Parsing with Multiple Layers

$a \leftarrow$ link probabilities
$m \leftarrow minimum\ layer\ id$ ▷ Discard the a from layers below minimum layer
$thres \leftarrow 0.8$ ▷ Threshold of breakpoint
procedure BUILDTREE(l, s, e) ▷ l: layer index, s: start index, e: end index
    if $e - s < 2$ **then** ▷ The constituent cannot be split
        return (s, e)
    $span \leftarrow a^l_{s \leq i < e}$
    $b \leftarrow$ **argmin**$(span)$ ▷ Get breakpoint
    $last \leftarrow$ **max**$(l - 1, m)$ ▷ Get index of last layer
    if $a^l_b > thres$ **then**
        if $l = m$ **then**
            return (s, e)
        return BuildTree$(last, s, e)$
    $tree1 \leftarrow$ **BuildTree**$(last, s, b)$
    $tree2 \leftarrow$ **BuildTree**$(last, b + 1, e)$
    return $(tree1, tree2)$ ▷ Return tree