```
def Exchange (pup, pdown, r):
    # This generates the transition matrix P for the telephone exchange
    # maximum size r
    # probability pup of one step up
    # probability i*pdown for queue size I for one step down
    # The output is the transition matrix P.
    P = np.zeros((r + 1, r + 1))
    P[0, 0] = 1 - pup
    P[0, 1] = pup
    P[r , r ] = 1 - pdown
    P[r , r - 1] = r* pdown
    for i in range(1, r):
        P[i, i - 1] = i*pdown
        P[i , i] = 1 – i*pdown - pup
        P[i , i + 1] = pup
    return(P)
```