

STEP II, 2018, Q13

- 13 Four children, A , B , C and D , are playing a version of the game 'pass the parcel'. They stand in a circle, so that $ABCD$ is the clockwise order. Each time a whistle is blown, the child holding the parcel is supposed to pass the parcel immediately exactly one place clockwise. In fact each child, independently of any other past event, passes the parcel clockwise with probability $\frac{1}{4}$, passes it anticlockwise with probability $\frac{1}{4}$ and fails to pass it at all with probability $\frac{1}{2}$. At the start of the game, child A is holding the parcel.

The probability that child A is holding the parcel just after the whistle has been blown for the n th time is A_n , and B_n , C_n and D_n are defined similarly.

- (i) Find A_1 , B_1 , C_1 and D_1 . Find also A_2 , B_2 , C_2 and D_2 .
- (ii) By first considering $B_{n+1} + D_{n+1}$, or otherwise, find B_n and D_n .
Find also expressions for A_n and C_n in terms of n .



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