binomial_density

September 9, 2022

Assume that a baseball team has an average pitcher, that is, one whose probability of winning any decision is 0.5. If this pitcher has 30 decisions in a session, what is the probability that he will win at least 20 decisions

[ ]:
```python
def binom_coeff(n:int, k:int) -> int:
    """Compute the binomial coefficient with Pascal's triangle

        1   1
        1   2   1
        1   3   3   1
        1   4   6   4   1 ...

    Args:
        n (int): number of trials
        k (int): number of successes

    Returns:
        int: the binomial coefficient
    """

    if k==0:
        return 1

    if n==0:
        return 0

    return binom_coeff(n-1, k) + binom_coeff(n-1, k-1)


def binom_density_function(p:float, n:int, k:int)->float:
    """return the binomial densifty function

    Args:
        p (float): probability of success
        n (_type_): number of trials
        k (int): number of success

    Returns:
```

```
        float: binomial density function at the probability p
    """
    return binom_coeff(n, k) * p**k * (1-p)**(n-k)


def binom_cdf(p:float, n:int, k:int)->float:
    """return the binomial cumulative density function
        k <= n

    Args:
        p (float): probability of success
        n (int): number of trials
        k (int): number of success

    Returns:
        float: cumulative density function at the probability p
    """
    cdf = 0
    for i in range (k+1):
        cdf += binom_density_function(p=p, n=n, k=i)

    return cdf

1-binom_cdf(p=0.5, n=30, k=19)
```

[ ]: 0.04936857335269451