2.

Let i from 1 to K, there are $\lfloor \frac{K}{2} \rfloor$ that $g(x_i) \neq f(x_i)$

since when i is even, $g(x_i) \neq f(x_i)$.

$\Rightarrow$ from $N+1$ to $N+L$, there are $\lfloor \frac{N+L}{2} \rfloor - \lfloor \frac{N}{2} \rfloor$ elements

make $g(x_i) \neq f(x_i)$ $\Rightarrow$ $E_{OTS}(g, f) = \frac{1}{L}\left(\lfloor \frac{N+L}{2} \rfloor - \lfloor \frac{N}{2} \rfloor\right)$ *.

3.

There are 2^L different f(x).

For $A_1(D)$, there are 1 f(x) makes $f(x) \neq g(x)$ for all x; there are L f(x) makes only one x satisfy $f(x) = g(x)$ … . And for $A_2(D)$, it's also the same as $A_1(D)$.

We can know that:

$$E_f\{E_{OTS}(A_1(D), f)\} = \frac{\left(L + \binom{L}{1}(L-1) + \cdots + 0\right)}{2^L} = E_f\{E_{OTS}(A_2(D), f)\}$$

4.

(1) $\upsilon \le 0.1 \rightarrow$ there are 0 or 1 orange marbles in a sample of 10 marbles:

$P(\upsilon \le 0.1) = 0.2^{10} + \binom{10}{1}0.8^1 0.2^9 \fallingdotseq 4.2 \times 10^{-6}$

(2) $\upsilon \ge 0.9 \rightarrow$ there are 9 or 10 orange marbles in a sample of 10 marbles:

$P(\upsilon \ge 0.9) = 0.8^{10} + \binom{10}{9}0.8^9 0.2^1 \fallingdotseq 0.3758$

5.

A: green-1.3.5 orange-2.4.6 B: green-2.4.6 orange-1.3.5

C: green-4.5.6 orange-1.2.3 D: green-1.2.3 orange-4.5.6

Five green 1's $\rightarrow$ pick A or D: $(\frac{1}{2})^5 = \frac{1}{32}$

6.

There are 4 situations in this 5 picked dice:

a. only contain A,C b. only contain A,D c. only contain B,C d. only contain B,C

and each of this four situations has the same probability $= 4 * (\frac{1}{2})^5 = \frac{1}{8}$

However, the situation that the 5 picked dice are the same type will be counted

two times, which is $4 * \left(\frac{1}{4}\right)^5 = \frac{1}{256}$

Hence, the probability is: $\frac{1}{8} - \frac{1}{256} = \frac{31}{256}$

7.

Average number of updates before the algorithm halts: 39.52

Histogram: