$$2 \quad 3 \quad 5 \quad \overset{\downarrow}{7} \quad 11 \quad 13 \quad 17 \quad 19$$

$$16 \rightarrow 2$$

$$N = 6 \quad \rightarrow \sqrt{6} \simeq 2$$

$$\boxed{a}\, b = N \quad 6 \times 10^5$$

$$300 \times 6 \times 10^5$$

$$i = 2;\ i \leq 2;\ i{+}{+}$$

$$\simeq 18 \times 10^7$$

$$i,\ N/i$$

$$\simeq 1.8 \times 10^8$$

$$2^3 \times 3^2 \times 5^4 = N = 45000$$

$$i = 5;\ i \leq 25;\ i{+}{+}$$

$$3^2 \times 5^4 = N = 5625$$

$$\log_{10}(219173253 4) \simeq 9$$

$$\log_{10}(1231) = x$$

$$(999997)^2 = N$$

$$10^x = 1231$$

$$10^3 = 1000$$

$$\log_{10}(N) = 14$$

$$dig(N) = \log_{10}(N) + 1$$

$$dig(N!) = dig(1 \cdot 2 \cdot 3 \cdot 4 \cdot \ \cdots\ N)$$

$$\log(AB) = \log A + \log B$$

$$= \log_{10}(1 \cdot 2 \cdot 3 \cdot 4 \cdots N) + 1$$

$$= \log_{10}(1) + \log_{10}(2) + \log_{10}(3) + \cdots + \log_{10}(N) + 1$$

$$= \log_{10}(1) + \log_{10}(2) + \log_{10}(3) + \cdots + \log_{10}(N) + 1$$

$$= \sum_{i=1}^{N} \log_{10}(i) + 1$$

$$\log_a N = \frac{\log_k N}{\log_k a}$$

$$\boxed{\log_{10} N} = \frac{\boxed{\log_2 N}}{\log_2 10}$$

$$f(N!) = \boxed{\log_b (N!)} + 1$$

$$\log_2 N = \log_{10} N \times \boxed{\log_2 10}$$

$$= \left(\frac{\log_{10}(N!)}{\log_{10} b} \right) + 1$$

$$\log_{10}(N!) = \sum_{i=1}^{N} \log_{10}(i)$$

$$11! = \boxed{1} \times ②\times ③ \times \boxed{4} \times ⑤ \times \boxed{6} \times ⑦ \times \boxed{8}$$
$$\times ⑨ \times \boxed{10} \times ⑪$$

$$\log_b 10 = \frac{\log_{10} 10}{\log_{10} b}$$

$$\Rightarrow \log_b 10 = \frac{1}{\log_{10} b}$$

$$\frac{11}{2^3} = 2^{\cancel{8}4} \times 3^{\cancel{4}2} \times 5^2 \times 7 \times 11 \qquad 5+2+1 = 8$$

$$\frac{11}{2^2} = 5 \qquad 1 \; \cancel{2}_0 \; 3 \; \cancel{4}_0 \; 5 \; \cancel{6}_0 \; 7 \; \cancel{8}_0 \; 9 \; \cancel{10}_0 \; 11$$

$$f(N!, P) = \left\lfloor \frac{N}{P} \right\rfloor + \left\lfloor \frac{N}{P^2} \right\rfloor + \left\lfloor \frac{N}{P^3} \right\rfloor + \cdots + 0$$