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H27-1

1) $T = \begin{pmatrix} 0.5 & 0.4 & 0.3 \\ 0.4 & 0.5 & 0.3 \\ 0.1 & 0.1 & 0.4 \end{pmatrix}$

a) T^2

$$T^2 = \frac{1}{100}\begin{pmatrix} 5 & 4 & 3 \\ 4 & 5 & 3 \\ 1 & 1 & 4 \end{pmatrix}\begin{pmatrix} 5 & 4 & 3 \\ 4 & 5 & 3 \\ 1 & 1 & 4 \end{pmatrix} = \frac{1}{100}\begin{pmatrix} 44 & 43 & 39 \\ 43 & 44 & 39 \\ 13 & 13 & 22 \end{pmatrix} = \begin{pmatrix} 0.44 & 0.43 & 0.39 \\ 0.43 & 0.44 & 0.39 \\ 0.13 & 0.13 & 0.22 \end{pmatrix}$$

$25+16+3,\quad 20+20+3 \qquad 15+12+12$

b) Aのすべての固有値と、それに対応する固有ベクトル.

$$A = \frac{1}{10}\begin{pmatrix} 2 & 1 \\ 1 & 2 \end{pmatrix}$$

$$|A-\lambda E| = \frac{1}{10}\begin{vmatrix} 2-10\lambda & 1 \\ 1 & 2-10\lambda \end{vmatrix} = \frac{1}{10}\left\{(2-10\lambda)^2 - 1\right\}$$

$$= \frac{1}{10}\left\{100\lambda^2 - 40\lambda + 3\right\}$$

$100\lambda^2 - 40\lambda + 3 = 0$ $\qquad 10\lambda = 3, 1$

$x^2 - 4x + 3 = 0$ $\qquad \lambda = \frac{1}{10}, \frac{3}{10}$ //

$(x-3)(x-1) = 0$

i) $\lambda = \frac{1}{10}$について.

$(A - \frac{1}{10}E)\boldsymbol{x} = 0$ を解く.

$$\frac{1}{10}\begin{pmatrix} 1 & 1 \\ 1 & 1 \end{pmatrix}\boldsymbol{x} = 0 \qquad \begin{pmatrix} 1 & 1 \\ 1 & 1 \end{pmatrix} \to \begin{pmatrix} 1 & 1 \\ 0 & 0 \end{pmatrix}$$

$x + y = 0$

$\boldsymbol{x} = t\begin{pmatrix} 1 \\ -1 \end{pmatrix} \quad (t \in \mathbb{R})$

よって 固有ベクトル $\boldsymbol{x} = t\begin{pmatrix} 1 \\ -1 \end{pmatrix} \quad (t \in \mathbb{R})$

(ii) $\lambda = \frac{3}{10}$ について.

$(A - \frac{3}{10}E)\boldsymbol{x} = \boldsymbol{0}$ を解く.

$$\frac{1}{10}\begin{pmatrix} -1 & 1 \\ 1 & -1 \end{pmatrix}\boldsymbol{x} = 0 \qquad \begin{pmatrix} -1 & 1 \\ 1 & -1 \end{pmatrix} \to \begin{pmatrix} -1 & 1 \\ 0 & 0 \end{pmatrix}$$

$-x + y = 0$ よって $\boldsymbol{x} = t\begin{pmatrix} 1 \\ 1 \end{pmatrix}$

よって固有ベクトル $\boldsymbol{x} = t\begin{pmatrix} 1 \\ 1 \end{pmatrix}$ $(t \in \mathbb{R})$

c) 正の整数Nについて、$A^N\boldsymbol{b}$ および $\sum_{n=0}^{N} A^n\boldsymbol{b}$ を求めよ.

$P = \begin{pmatrix} 1 & 1 \\ -1 & 1 \end{pmatrix}$ とすると $P^{-1} = \frac{1}{2}\begin{pmatrix} 1 & -1 \\ 1 & 1 \end{pmatrix}$

$$P^{-1}AP = \begin{pmatrix} \frac{1}{10} & 0 \\ 0 & \frac{3}{10} \end{pmatrix}$$

$$A^N = P\begin{pmatrix} (\frac{1}{10})^N & 0 \\ 0 & (\frac{3}{10})^N \end{pmatrix}P^{-1} = \begin{pmatrix} 1 & 1 \\ -1 & 1 \end{pmatrix}\begin{pmatrix} (\frac{1}{10})^N & 0 \\ 0 & (\frac{3}{10})^N \end{pmatrix}P^{-1}$$

$$= \frac{1}{2}\begin{pmatrix} (\frac{1}{10})^N & (\frac{3}{10})^N \\ -(\frac{1}{10})^N & (\frac{3}{10})^N \end{pmatrix}\begin{pmatrix} 1 & -1 \\ 1 & 1 \end{pmatrix}$$

$$= \frac{1}{2}\begin{pmatrix} (\frac{1}{10})^N + (\frac{3}{10})^N & -(\frac{1}{10})^N + (\frac{3}{10})^N \\ -(\frac{1}{10})^N + (\frac{3}{10})^N & (\frac{1}{10})^N + (\frac{3}{10})^N \end{pmatrix}$$

$$A^N\boldsymbol{b} = \frac{1}{2\cdot 10^N}\begin{pmatrix} 3^N+1 & 3^N-1 \\ 3^N-1 & 3^N+1 \end{pmatrix}\begin{pmatrix} \frac{3}{10} \\ \frac{3}{10} \end{pmatrix} = \frac{3}{2\cdot 10^{N+1}}\begin{pmatrix} 3^N+1 & 3^N-1 \\ 3^N-1 & 3^N+1 \end{pmatrix}\begin{pmatrix} 1 \\ 1 \end{pmatrix}$$

$$= \frac{3}{2\cdot 10^{N+1}}\begin{pmatrix} 2\cdot 3^N \\ 2\cdot 3^N \end{pmatrix} = \frac{3^{N+1}}{10^{N+1}}\begin{pmatrix} 1 \\ 1 \end{pmatrix} = \left(\frac{3}{10}\right)^{N+1}\begin{pmatrix} 1 \\ 1 \end{pmatrix}$$

$$\sum_{n=0}^{N} A^n b = \left(\frac{3}{10}\right)\begin{pmatrix}1\\1\end{pmatrix} + \left(\frac{3}{10}\right)^2\begin{pmatrix}1\\1\end{pmatrix} + \left(\frac{3}{10}\right)^3\begin{pmatrix}1\\1\end{pmatrix} + \cdots + \left(\frac{3}{10}\right)^{N+1}\begin{pmatrix}1\\1\end{pmatrix}$$

$$= \begin{pmatrix} \frac{3}{10} + \left(\frac{3}{10}\right)^2 + \cdots + \left(\frac{3}{10}\right)^{N+1} \\ 〃 \end{pmatrix}$$

$$S = \frac{3}{10} + \left(\frac{3}{10}\right)^2 + \cdots + \left(\frac{3}{10}\right)^{N+1}$$

$$\frac{3}{10}S = \left(\frac{3}{10}\right)^2 + \cdots + \left(\frac{3}{10}\right)^{N+2}$$

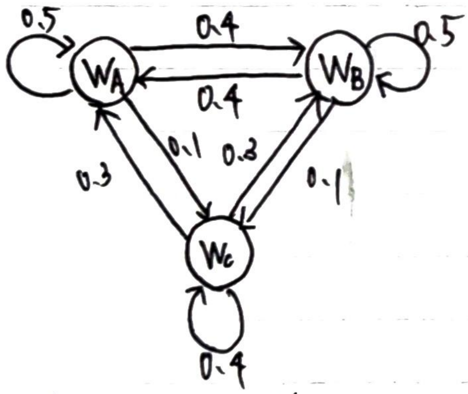
$$\frac{7}{10}S = \frac{3}{10} - \left(\frac{3}{10}\right)^{N+2}$$

$$S = \frac{10}{7}\left\{\frac{3}{10} - \left(\frac{3}{10}\right)^{N+2}\right\}$$

$$= \frac{3}{7}\left\{1 - \left(\frac{3}{10}\right)^{N+1}\right\}$$

$$\sum_{n=0}^{N} A^n b = \frac{3}{7}\left\{1 - \left(\frac{3}{10}\right)^{N+1}\right\}\begin{pmatrix}1\\1\end{pmatrix}$$ //

2)



a) WAからハイパーリンクを2回クリックした後に再びWAにいる確率.

$A \to A \to A$: $\frac{5}{10} \times \frac{5}{10} = \frac{25}{100}$

$\to B \to A$: $\frac{4}{10} \times \frac{4}{10} = \frac{16}{100}$

$\to C \to A$: $\frac{1}{10} \cdot \frac{3}{10} = \frac{3}{100}$

$\frac{44}{100}$

0.44 //

b) N回クリックした後にWAおよびWBにいる確率をP_N, Q_Nとする

P_{N-1}, Q_{N-1}を用いてP_N, Q_Nを表せ.

$$P_N = \frac{5}{10}P_{N-1} + \frac{4}{10}Q_{N-1} + \frac{3}{10}(1 - P_{N-1} - Q_{N-1})$$

$$= \frac{3}{10} + \frac{2}{10}P_{N-1} + \frac{1}{10}Q_{N-1}$$

$$Q_N = \frac{4}{10}P_{N-1} + \frac{5}{10}Q_{N-1} + \frac{3}{10}(1 - P_{N-1} - Q_{N-1})$$

$$= \frac{3}{10} + \frac{1}{10}P_{N-1} + \frac{2}{10}Q_{N-1}$$

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c) $P_0 = Q_0 = 0.3$

$R_N = P_N + Q_N = \cancel{\frac{9}{10}P_{N-1} + \frac{9}{10}Q_{N-1}} = \frac{6}{10} + \frac{3}{10}P_{N-1} + \frac{3}{10}Q_{N-1}$

$= \frac{3}{10}R_{N-1} + \frac{6}{10}$

$\cancel{10R_N = 3R_{N-1} + 6}$ $\quad \cancel{10x^2 - 3x - 6 = 0}$

$\cancel{x^2 - \frac{3}{10}x - \frac{6}{10} = 0}$

$\alpha = \frac{3}{10}\alpha + \frac{6}{10}$

$\frac{7}{10}\alpha = \frac{6}{10} \rightarrow \alpha = \frac{6}{7}$

$\left(R_N - \frac{6}{7}\right) = \frac{3}{10}\left(R_{N-1} - \frac{6}{7}\right)$

$R_0 = \frac{6}{10}$, $\quad R_0 - \frac{6}{7} = \frac{6}{10} - \frac{6}{7} = \frac{42-60}{70} = -\frac{18}{70}$

$R_N - \frac{6}{7} = -\frac{18}{70}\left(\frac{3}{10}\right)^{N}$

$R_N = -\frac{18}{70}\left(\frac{3}{10}\right)^{N} + \frac{6}{7} = -\frac{9}{35}\left(\frac{3}{10}\right)^{N} + \frac{6}{7}$

$S_N = P_N - Q_N = P_{N-1} - Q_{N-1} = S_{N-1}$.

$S_0 = 0 \qquad S_N = 0$

よって.

$\frac{1}{2}(R_N + S_N) = \frac{1}{2}(P_N + Q_N + P_N - Q_N) = P_N$

$P_N = \frac{1}{2}\left\{-\frac{9}{35}\left(\frac{3}{10}\right)^N + \frac{6}{7}\right\} = -\frac{9}{70}\left(\frac{3}{10}\right)^N + \cancel{\frac{6}{14}} + \frac{3}{7} = \frac{3}{7}\left\{1 - \left(\frac{3}{10}\right)^{N+1}\right\}$

$\frac{1}{2}(R_N - S_N) = \frac{1}{2}\{P_N + Q_N - P_N + Q_N\} = Q_N$

$Q_N = \frac{1}{2}\left\{-\frac{9}{35}\left(\frac{3}{10}\right)^N + \frac{6}{7}\right\} = -\frac{9}{70}\left(\frac{3}{10}\right)^N + \frac{3}{7} = \frac{3}{7}\left\{1 - \left(\frac{3}{10}\right)^{N+1}\right\}$

d) $\lim_{N\to\infty} P_N = \lim_{N\to\infty} \frac{3}{7}\left\{1 - \left(\frac{3}{10}\right)^{N+1}\right\} = \frac{3}{7}$

$\lim_{N\to\infty} Q_N = \frac{3}{7}$

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H27-2

$f(x) = \mathrm{sgn}(x) + \cos\pi x + \sin 5\pi x \quad (-1 \leq x < 1)$

$$\mathrm{sgn}(x) = \begin{cases} -1 & (-1 \leq x < 0) \\ 1 & (0 \leq x < 1) \end{cases}$$

1) 2つの実数αとβを用いて関数 $g(x) = \alpha\cos\pi x + \beta\sin 5\pi x$

$$E(\alpha,\beta) = \int_{-1}^{1} |f(x) - g(x)|^2 dx$$

をαとβの2次関数で表せ.

$(a+b+c)^2$
$a^2+b^2+c^2+2ab+2bc+2ca$

$$E(\alpha\beta) = \int_{-1}^{1} |f(x) - g(x)|^2 dx = \int_{-1}^{1} (f(x) - g(x))^2 dx$$

$$= \int_{-1}^{1} \left(\mathrm{sgn}(x) + (1-\alpha)\cos\pi x + (1-\beta)\sin 5\pi x\right)^2 dx$$

$$= \int_{-1}^{1} \{\mathrm{sgn}(x)\}^2 + (1-\alpha)^2\cos^2\pi x + (1-\beta)^2\sin^2 5\pi x + 2\,\mathrm{sgn}(x)(1-\alpha)\cos\pi x + 2\,\mathrm{sgn}(x)(1-\beta)\sin 5\pi x$$
$$+ 2(1-\alpha)(1-\beta)\cos\pi x\sin 5\pi x \quad dx$$

$$\int_{-1}^{1} \{\mathrm{sgn}(x)\}^2 = \int_{-1}^{1} 1\, dx = \underline{2}$$

$$\int_{-1}^{1} (1-\alpha)^2\cos^2\pi x = (1-\alpha)^2 \int_{-1}^{1} \cos^2\pi x\, dx = \frac{(1-\alpha)^2}{\pi} \int_{-\pi}^{\pi} \cos^2 t\, dt$$

$\pi x = t$

$\cos 2t = \cos^2 t - \sin^2 t$
$= 2\cos^2 t - 1$

$$= \frac{(1-\alpha)^2}{\pi} \int_{-\pi}^{\pi} \frac{1+\cos 2t}{2} dt$$

$$= \frac{(1-\alpha)^2}{\pi} \left[\frac{1}{2}t + \frac{1}{4}\sin 2t\right]_{-\pi}^{\pi} = \frac{(1-\alpha)^2}{\pi}\left(\frac{\pi}{2} + \frac{\pi}{2}\right) = \underline{(1-\alpha)^2}$$

$$\int_{-1}^{1} (1-\beta)^2 \underbrace{\sin^2 5\pi x}_{\text{奇}\times\text{奇}=\text{奇}} = 0$$

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$$2\int_{-1}^{1} \mathrm{sgn}(x)(1-\alpha)\cos\pi x + \mathrm{sgn}(x)(1-\beta)\sin 5\pi x \, dx$$

$$= 2\left\{\int_{-1}^{0} -(1-\alpha)\cos\pi x - (1-\beta)\sin 5\pi x\, dx + \int_{0}^{1}(1-\alpha)\cos\pi x + (1-\beta)\sin 5\pi x\, dx\right\}$$

$$= 2\left\{\left[-(1-\alpha)\frac{\sin\pi x}{\pi} + (1-\beta)\frac{\cos 5\pi x}{5\pi}\right]_{-1}^{0} + \left[\frac{(1-\alpha)}{\pi}\sin\pi x - \frac{(1-\beta)}{5\pi}\cos 5\pi x\right]_{0}^{1}\right\}$$

$$= 2\left\{\frac{(1-\beta)}{5\pi} + \frac{(1-\beta)}{5\pi} + \frac{(1-\beta)}{5\pi} + \frac{(1-\beta)}{5\pi}\right\} = \cancel{\frac{8}{5}\pi(1-\beta)} \quad \frac{8}{5\pi}(1-\beta)$$

$$\int_{-1}^{1} 2(1-\alpha)(1-\beta)\underbrace{\cos\pi x \sin 5\pi x}_{偶\times奇 = 奇}\, dx = 0$$

偶×偶＝偶

奇×偶＝奇

奇×奇＝偶

よって $(与式) = 2 + (1-\alpha)^2 + \cancel{\frac{8}{5}\pi(1-\beta)}$ $\frac{8}{5\pi}(1-\beta)$

$$\int_{-1}^{1}(1-\beta)^2\underbrace{\sin^2 5\pi x}_{奇\times奇=偶}\, dx = \frac{(1-\beta)^2}{5\pi}\int_{-5\pi}^{5\pi}\sin^2 t\, dt = \frac{(1-\beta)^2}{5\pi}\int_{-5\pi}^{5\pi}\frac{1-\cos 2t}{2}\, dt$$

$5\pi x = t$ ⟺ $x \mid -1 \to 1$

$5\pi dx = dt$ 　 $t \mid -5\pi \to 5\pi$

$\cos 2t = \cos^2 t - \sin^2 t = 1 - 2\cos^2 t$

$$= \frac{(1-\beta)^2}{5\pi}\left[\frac{1}{2}t - \frac{\sin 2t}{4}\right]_{-5\pi}^{5\pi}$$

$$= \frac{(1-\beta)^2}{5\pi}\left\{\frac{5}{2}\pi + \frac{5}{2}\pi\right\} = (1-\beta)^2 \,//$$

よって $(与式) = 2 + (1-\alpha)^2 + (1-\beta)^2 + \frac{8}{5}\pi(1-\beta)$

2) $E(\alpha,\beta)$ が最小となるときの α, と β と $E(\alpha,\beta)$ の値.

$1-\alpha = X$, $1-\beta = Y$ とおく

$$E(\alpha,\beta) = 2 + X^2 + Y^2 + \frac{8}{5\pi}Y = 2 + X^2 + \left(Y + \frac{4}{5\pi}\right)^2 - \frac{16}{25\pi^2}$$

よって $X=0$, $Y = -\frac{4}{5\pi}$ のとき最小.

$\alpha = 1$, $\beta = \frac{9}{5}$, $E(\alpha,\beta) =$ $\cancel{2 - \frac{16}{25}\pi^2}$ // 　 $2 - \frac{16}{25\pi^2}$

$\beta = 1 + \frac{4}{5\pi}$

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3) $\tilde{f}(t)$ $(-\infty < t < \infty)$ を $\tilde{f}(x+2m) = f(x)$ $(-1 \leq x < 1)$
mは任意の整数.

$\tilde{f}(t)$ を $\frac{a_0}{2} + \sum_{n=1}^{\infty}(a_n \cos n\pi t + b_n \sin n\pi t)$ の形にフーリエ級数展開.

$\cancel{a_m = \int_{-\pi}^{\pi} \tilde{f}(t) \cos m\pi x}$

$f(x) = \mathrm{sgn}(x) + \cos\pi x + \sin 5\pi x$ を
$\tilde{f}(x+2m) = f(x)$ $(-1 \leq x < 1$, mは任意の整数$)$
↳ 周期2
$\tilde{f}(0) = f(0)$, $\tilde{f}(2) = f(0)$

$\cancel{a_0}$ $a_m = \int_{-1}^{1} f(x) \cos(m\pi x)\, dx$

$$= \int_{-1}^{1} \underbrace{\underbrace{\mathrm{sgn}(x)}_{奇} \times \underbrace{\cos(m\pi x)}_{偶}}_{奇} + \underbrace{\underbrace{\cos\pi x}_{偶} \times \underbrace{\cos(m\pi x)}_{偶}}_{偶} + \underbrace{\underbrace{\sin 5\pi x}_{奇} \underbrace{\cos(m\pi x)}_{偶}}_{奇} dx$$

$$= \int_{-1}^{1} \cos\pi x \cdot \cos(m\pi x)\, dx$$

$\cos(\pi x + m\pi x) = \cos\pi x \cos m\pi x - \sin\pi x \sin m\pi x$
$\cos(\pi x - m\pi x) = \quad$ 〃 $\quad +$

$$= \frac{1}{2}\int_{-1}^{1} \cos(m+1)\pi x + \cos(m-1)\pi x\, dx$$

~~ここで m≠1 のとき,~~
m≠1 のとき $\frac{1}{2}\left[\frac{\sin(m+1)\pi x}{(m+1)\pi} + \frac{\sin(m-1)\pi x}{(m-1)\pi}\right]_{-1}^{1} = 0$

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$m=1$ のとき、

$$\int_{-1}^{1}\cos^2\pi x\,dx = \int_{-1}^{1}\frac{1+\cos 2\pi x}{2}\,dx = \left[\frac{x}{2}+\frac{\sin 2\pi x}{4\pi}\right]_{-1}^{1} = \frac{1}{2}+\frac{1}{2} = 1$$

よって $a_1=1,\ a_0=0,\ a_2=a_3=\cdots=a_n=\cdots=0$

$$b_m=\int_{-1}^{1} f(x)\sin(m\pi)x\,dx = \int_{-1}^{1}\underbrace{\underset{奇}{\mathrm{sgn}(x)}\underset{奇}{\sin(m\pi)x}}_{偶} + \underbrace{\underset{偶}{\cos\pi x}\,\underset{奇}{\sin(m\pi)x}}_{奇} + \underbrace{\underset{偶}{\sin 5\pi x}\,\underset{偶}{\sin(m\pi)x}}_{偶}\,dx$$

$$= 2\int_{0}^{1}\mathrm{sgn}(x)\sin m\pi x + \sin 5\pi x\sin m\pi x\,dx \qquad m\pi-5\pi$$

$$= 2\left[\frac{-\cos m\pi x}{m\pi}\right]_0^1 + 2\int_0^1\frac{1}{2}\left(\cos(m-5)\pi x-\cos(m+5)\pi x\right)dx \quad (m\neq 5\text{のとき})$$

$$\cancel{= \frac{-2\cdot(-1)^m}{m\pi} + \left[\frac{\sin(m-5)\pi x}{(m-5)\pi} - \frac{\sin(m+5)\pi x}{(m+5)\pi x}\right]_0^1}$$

$\cos m\pi = (-1)^m$ $\quad \cancel{= -\frac{2(-1)^m}{m\pi}}$

$$= \frac{-2(-1)^m}{m\pi} + \frac{2}{m\pi} = \frac{2}{m\pi}\left(1-(-1)^m\right)$$

$m=5$ のとき.

$$\frac{2}{5\pi}\left(1-(-1)^5\right) + \int_{-1}^{1}\sin^2 5\pi x\,dx$$

$$= \frac{4}{5\pi} + \int_{-1}^{1}\frac{1-\cos 10\pi x}{2}\,dx = \frac{4}{5\pi} + \left[\frac{x}{2}-\frac{\sin 10\pi x}{20\pi}\right]_{-1}^{1} = \frac{4}{5\pi}+\left(\frac{1}{2}+\frac{1}{2}\right) = \frac{4}{5\pi}+1$$

よって $a_n=\begin{cases}0 & (n\neq 1)\\ 1 & (n=1)\end{cases}$ $\quad b_n=\begin{cases}\dfrac{4}{5\pi}+1 & (n=5)\\ \dfrac{2}{n\pi}\{1-(-1)^n\} & (n\neq 5)\end{cases}$

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4) $\tilde{f}(t)$ のフーリエ級数に現れる全ての項に $t=\frac{1}{2}$ と $t=55$, $t=100$ を代入した場合の極限値

$$A = \frac{a_0}{2} + \lim_{N\to\infty} \sum_{n=1}^{N} \left(a_n \cos\tfrac{1}{2}n\pi + b_n \sin\tfrac{1}{2}n\pi\right)$$

$$B = \frac{a_0}{2} + \lim_{N\to\infty} \sum_{n=1}^{N} \left(a_n \cos 55n\pi + b_n \sin 55n\pi\right)$$

$$C = \frac{a_0}{2} + \lim_{N\to\infty} \sum_{n=1}^{N} \left(a_n \cos 100n\pi + b_n \sin 100n\pi\right)$$

フーリエ級数の各点収束定理より、

$$\left|A - \tilde{f}\left(\tfrac{1}{2}\right)\right| = 0$$

$$A = \tilde{f}\left(\tfrac{1}{2}\right) = f\left(\tfrac{1}{2}\right) = \mathrm{sgn}\left(\tfrac{1}{2}\right) + \cos\frac{\pi}{2} + \sin\frac{5}{2}\pi$$

$$= 1 + 1 = \underline{2}$$

$$\left|B - \tilde{f}(55)\right| = 0$$

$$B = \tilde{f}(55) = \tilde{f}(-1 + 2\cdot 28) = f(-1) = \mathrm{sgn}(-1) + \cos(\pi) - \sin(-5\pi)$$

$$= -1 - 1 = \underline{-2}$$

$$\left|C - \tilde{f}(100)\right| = 0$$

$$C = \tilde{f}(100) = \tilde{f}(0 + 50\cdot 2) = f(0) = \mathrm{sgn}(0) + \cos 0 + \sin 0$$

$$= 1 + 1 = \underline{2}$$

$$\underline{A = 2,\ B = -2,\ C = 2}$$

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H27-5

$$f(a,n) = \max\left\{ \sum_{k=i}^{j} a_k \mid 0 \le i \le j < n \right\}$$

$a = (20, -24, 36, 3, -7, 27, -40, 37, -28, 6)$
$f(a, 10) = 36 + 3 + (-7) + 27 = 39$

1) 関数f.

int max(int x, int y){}
↳ xとyの最大値を返す.

int sum(int a[], int i, int j){}
↳ a[i], a[i+1], …, a[j] の合計を返す.

```
int f(int a[], int n) {
    int s = a[0];
    for (int i=0; i<n; i++) {
        for(int j= [A]; j<n; j++) {
            s = max(s, sum(a,i,j));
        }
    }
    return s;
}
```

a)
$\boxed{A}$: i

b)
$\cancel{n^2}$ n^3
↳ sum関数でループしているので…

2) 工夫

```
int f(int a[], int n) {
    int s = a[0];
    for( int i=0; i<n; i++) {
        int t= 0;
        for( int j= i; j<n; j++) {
            t= t + [B];
            s = max(s, t);
        }
    }
    return s;
}
```

iで開始地点を決定
jで i+jまで足してみて検証.

a)
$\boxed{B}$: $\cancel{a}$ a[j]

b)
n^2

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c) 計算時間のオーダーが小さくなる理由

図5.1は a[i]~a[j] の合計値を計算するために、
関数sumを用いていたが、
図5.2は a[i]~a[j-1] の合計値に a[j]を足すことで求めているため。

3) $a_0, a_1, \cdots, a_{n-1}$ における連続の和を、
a_{n-1} を含む場合と含まない場合で考える。

・含まない … $f(a, n-1)$

・含む … ~~g(n)~~ $g(a,n) = \max\left\{ \sum_{k=i}^{n-1} a_k \mid 0 \le i < n \right\}$

$$f(a,n) = \max\{f(a,n-1), g(a,n)\}$$

```
int g(int a[], int n) {
    int t = [C];
    for (int k=1; k<n; k++)
        t = max(t+[D], [D]);
    return t;
}
```

```
int f(int a[], int n) {
    int s = a[0];
    for (int k=1; k<n; k++)
        s = max([E], g(a, [F]));
    return s;
}
```

a[n-1]を含めることは決定している。

$\boxed{C}$: a[0]

$\boxed{D}$: a[k]

s = a[0]

s = max(s, g(a, ※))

※ k+1

b) n^2

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4)

```
int f(int a[], int n){
    int t = a[0], s = a[0];

    for(int k=1; k<n; k++){
        t = max(t+a[k], a[k]);
        s = max(s, [G]);
    }
}
```

a)

$\boxed{G}$: t

b)

n

c)

図5.3は、for文の中で関数gを呼び出しているが、
図5.4は、1つのループで ~~gを計算して~~、a[k]が含まれる場合の最大値tと含まれない場合の最大値を比べている。