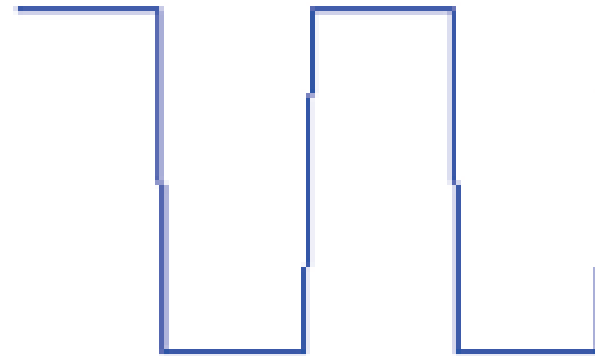
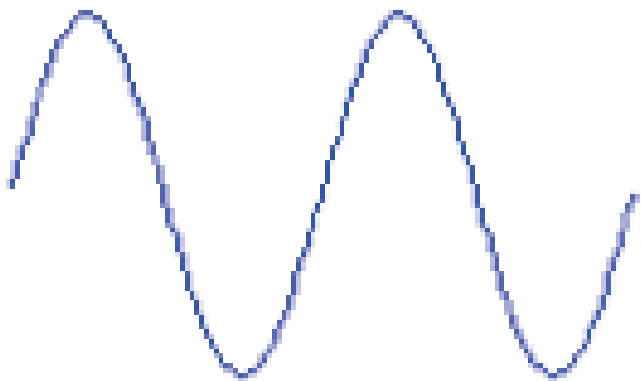


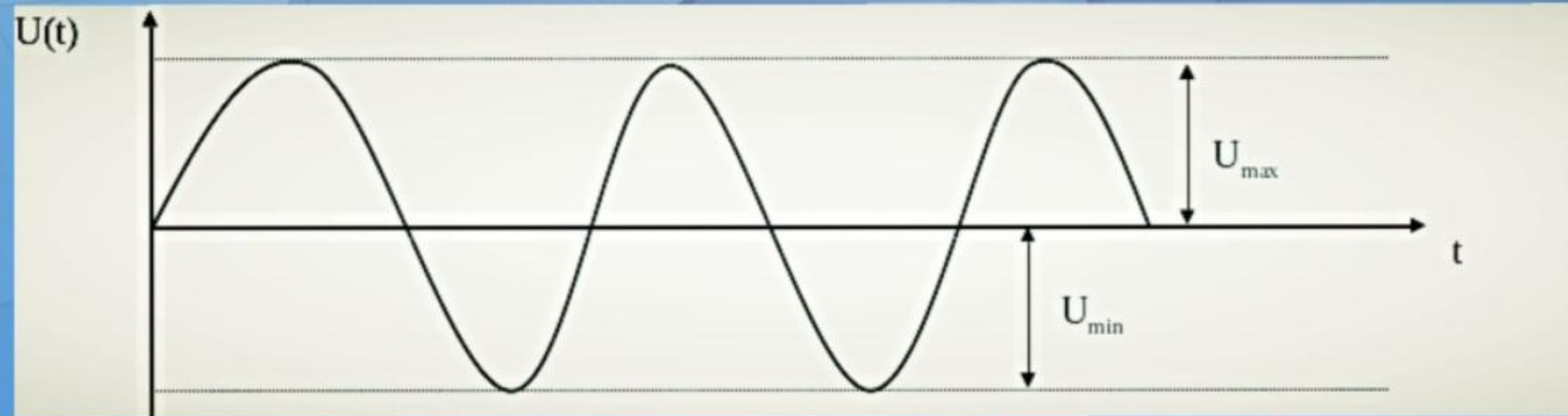
MAVZU: Analog-raqamli signallar. Analog signaldan raqamli signalga o'tish.



Analog signal

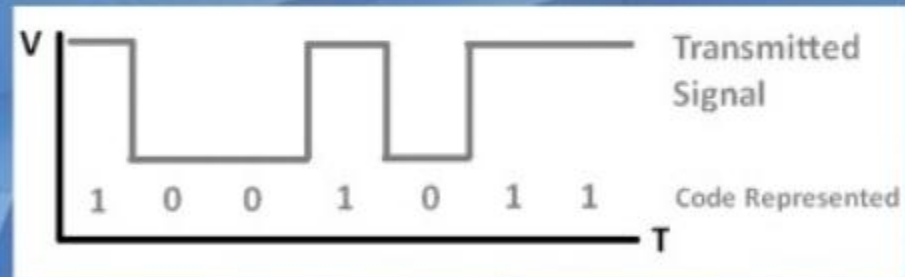
Analogli signal deb, analog signal amplitudasining maksimal va minimal oralig'ida cheksiz qiymatlar sonini qabul qilinishiga aytiladi.

—



Raqamli signal

Raqamli signal deb, cheklangan qiymatlar qabul qiladigan signalga aytiladi. Yani 0 va 1.



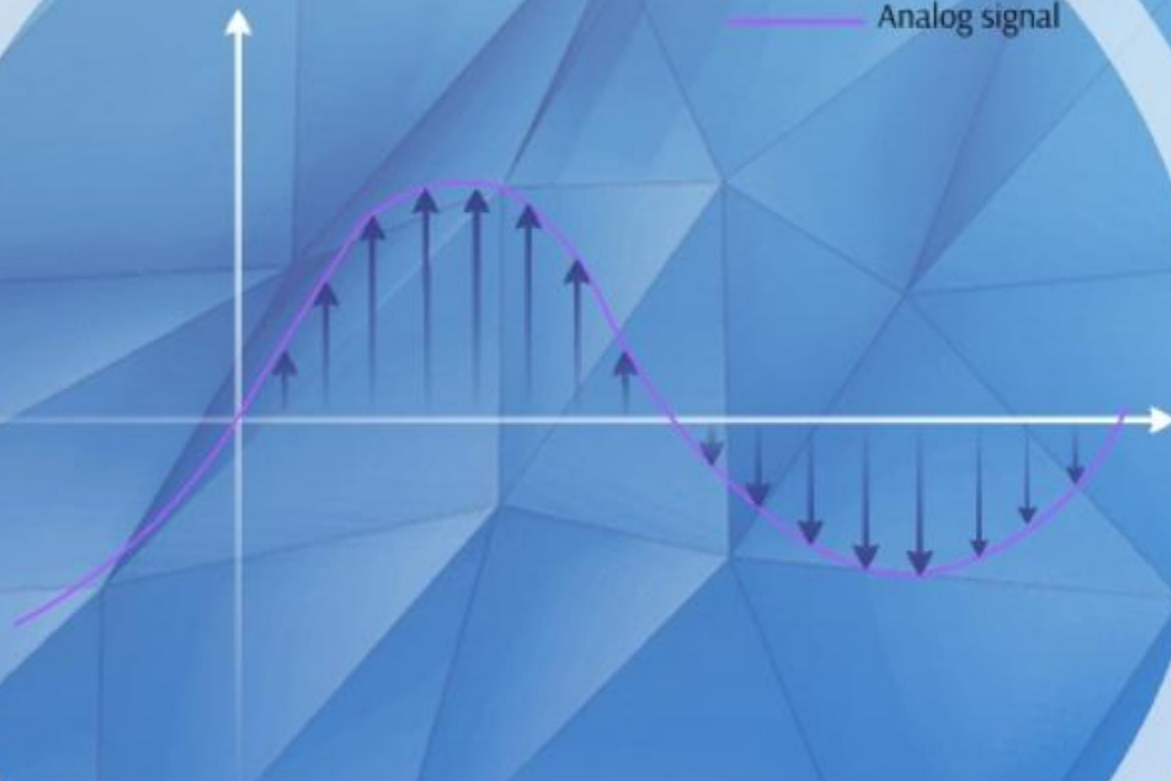
Analog signalni raqamli signalga o'tkazish 3 bosqichda amalga oshiriladi:

- Diskretlash;
- Kvantlash;
- Kodlash

Diskretlash deb, vaqt bo'yicha uzluksiz analog signalni ma'lum bir qonunyat asosida teng vaqt intervaliga ajratishga aytiladi.

Diskretlash

— Analog signal



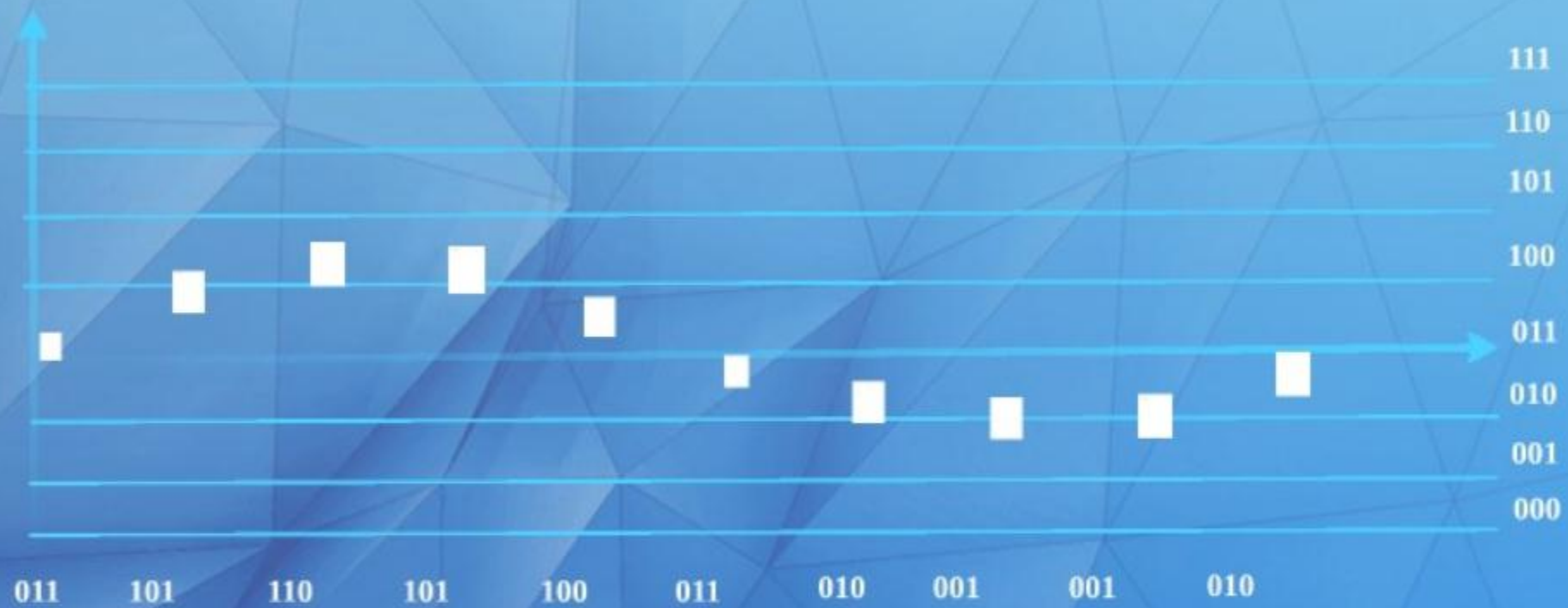
Kvantlash - diskretlangan analog signalni ma'lum qonunyat asosida kvantlash qadami yordamida gorizontal ravishda teng oraliqlarga bo'lish



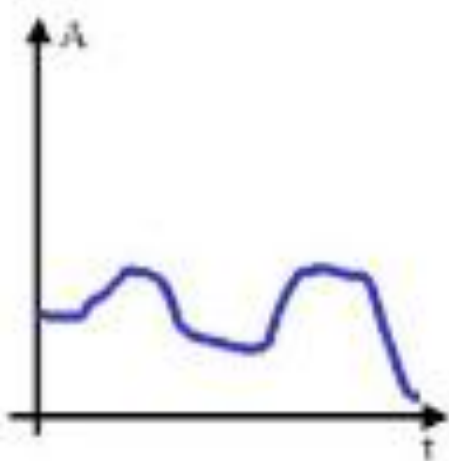
Diskretlash



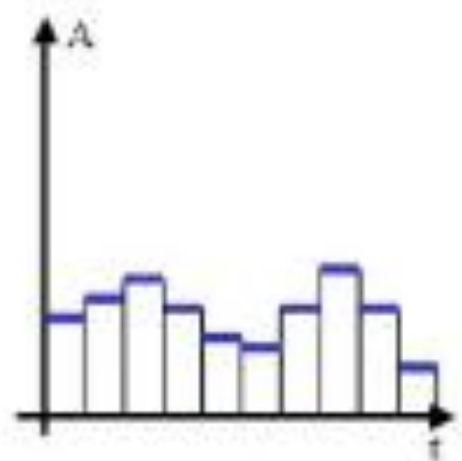
Bizning holda analog signal quydagicha kodlanadi



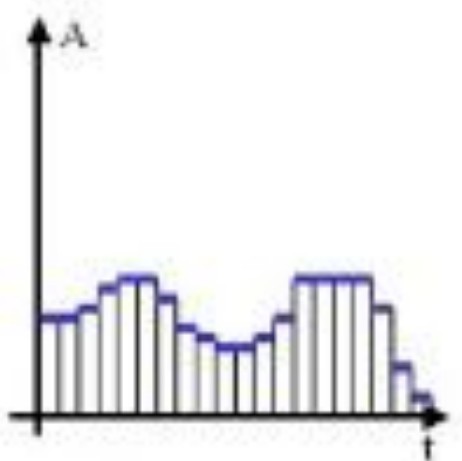




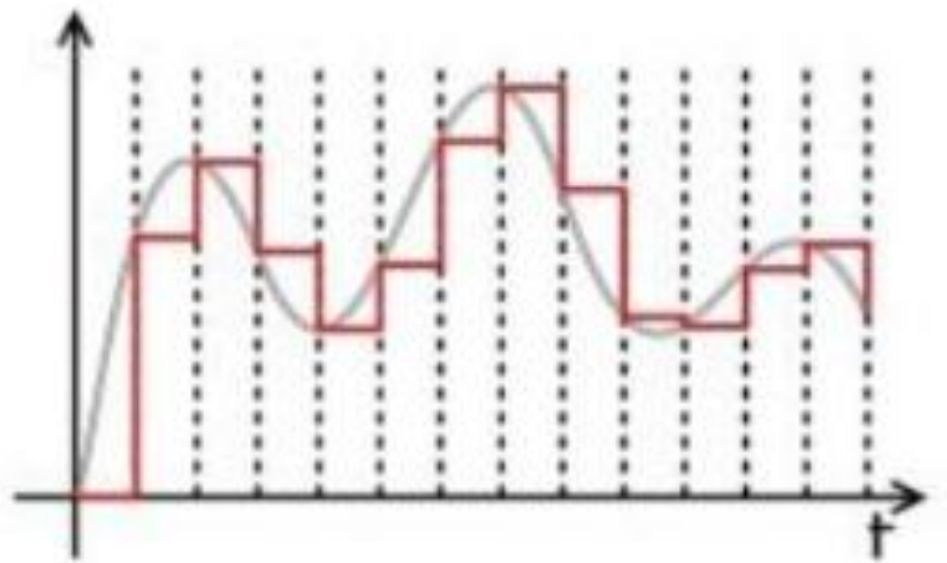
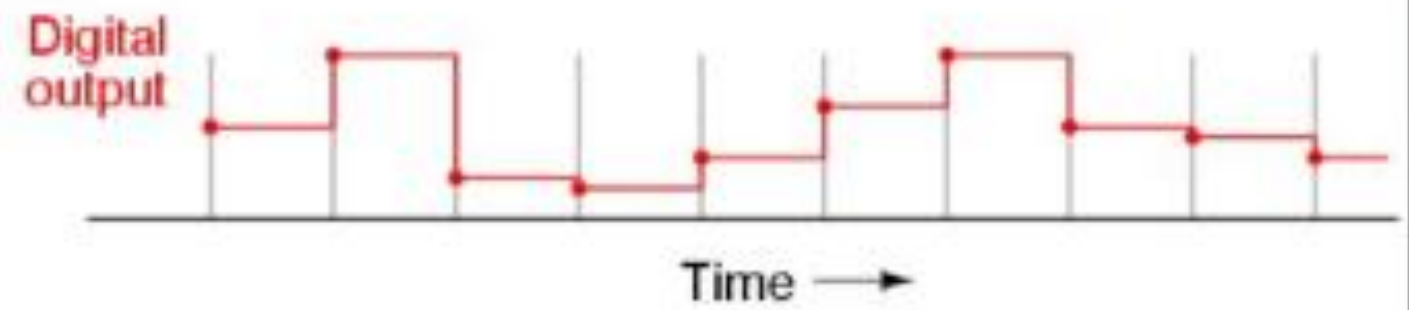
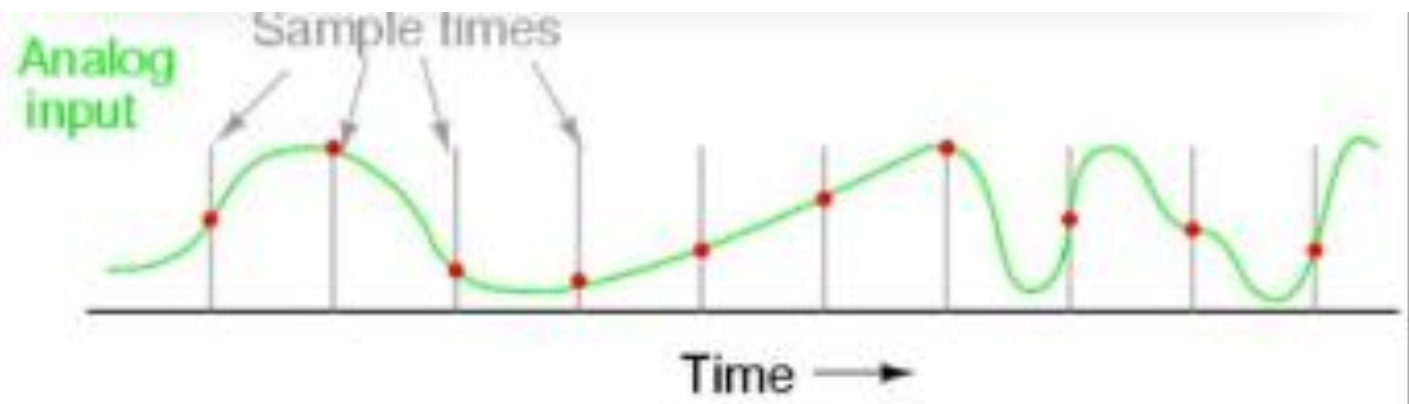
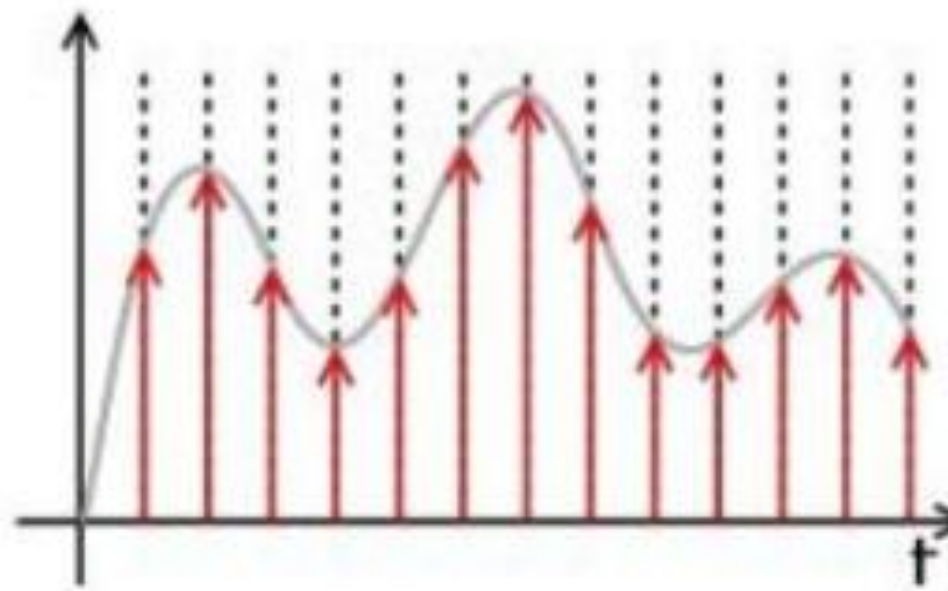
Analog signal – continuously varying



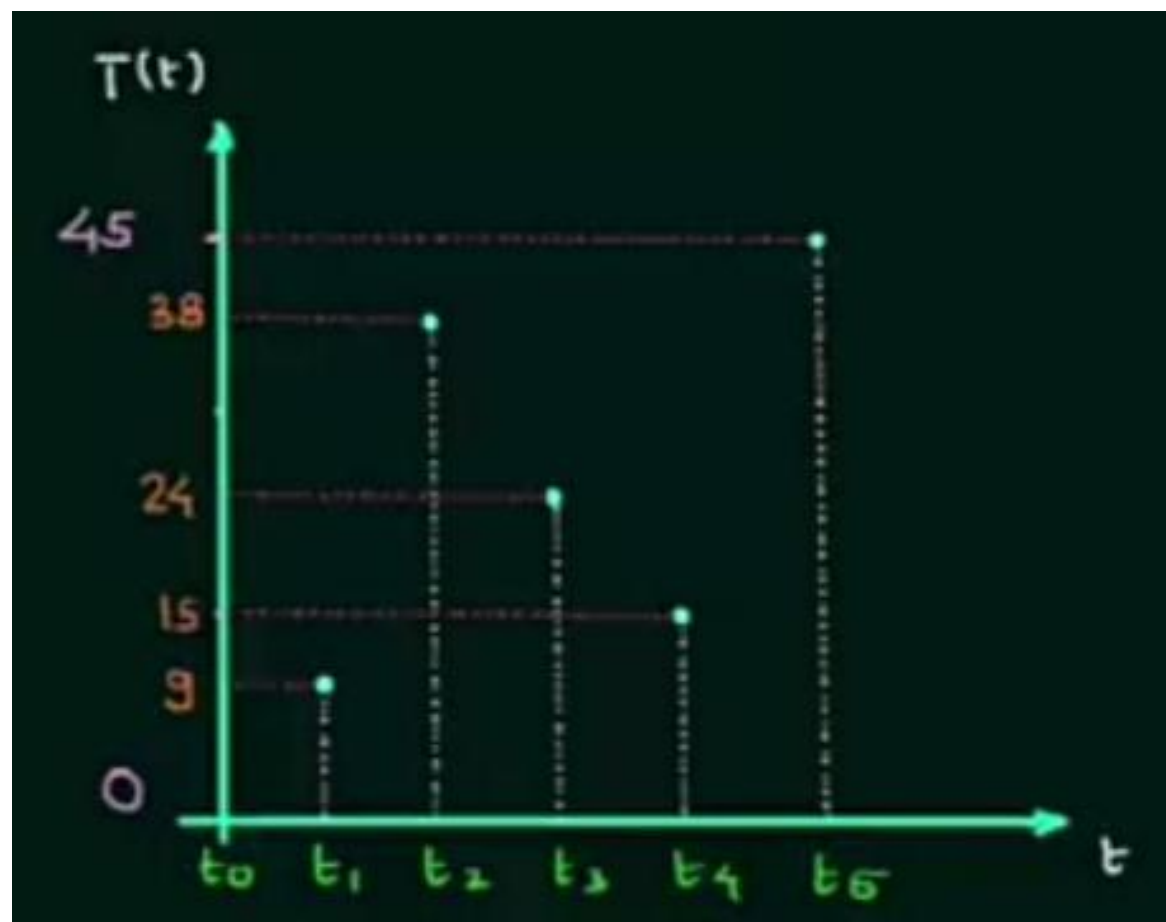
Digital signal – large time divisions

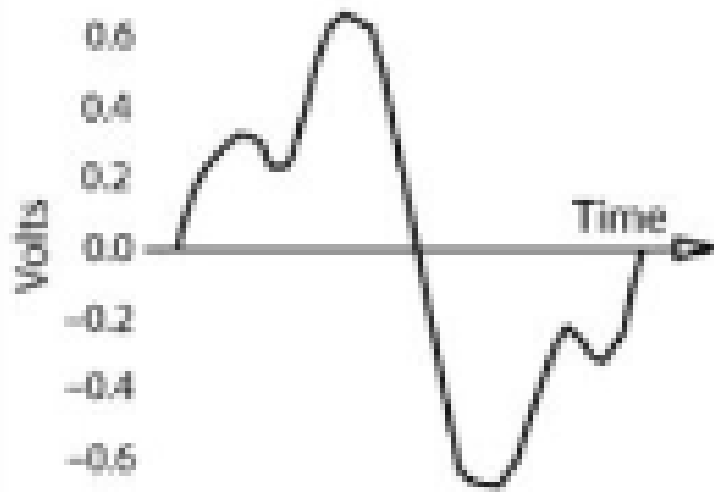


Digital signal – small time divisions

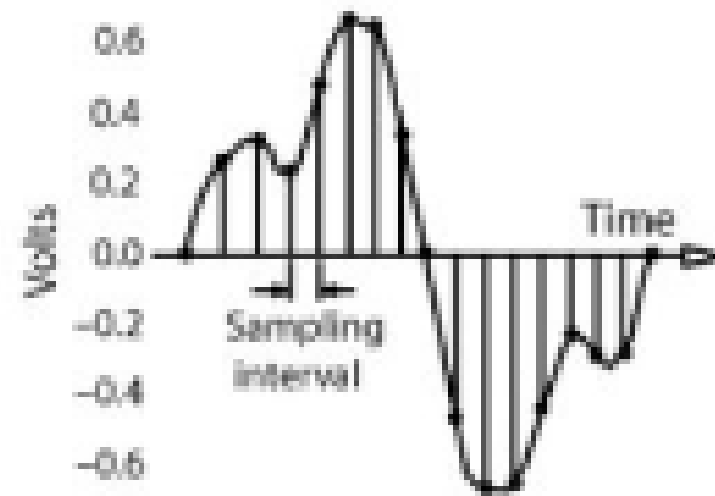


By discrete, it means
for any range of
digital signal wave,

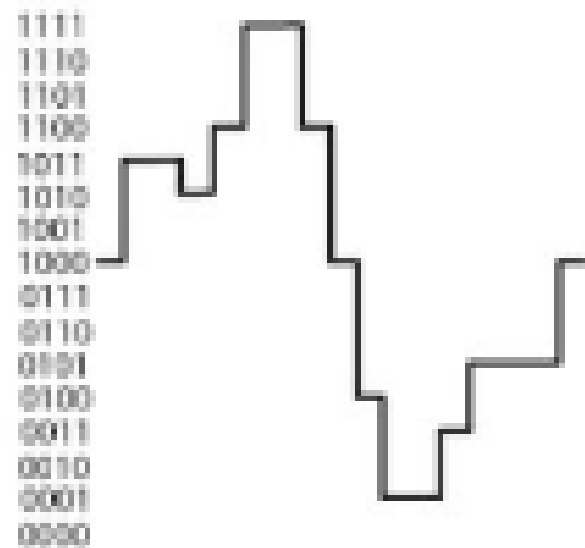




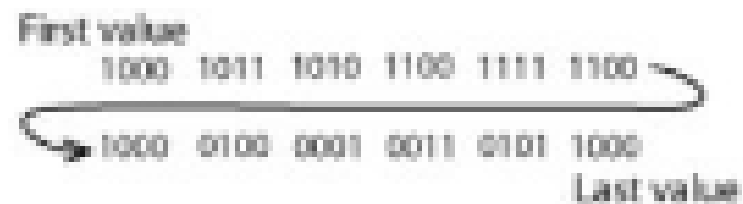
(A) The audio waveform enters the A/D converter.



(B) The voltage is measured or sampled at regular intervals.



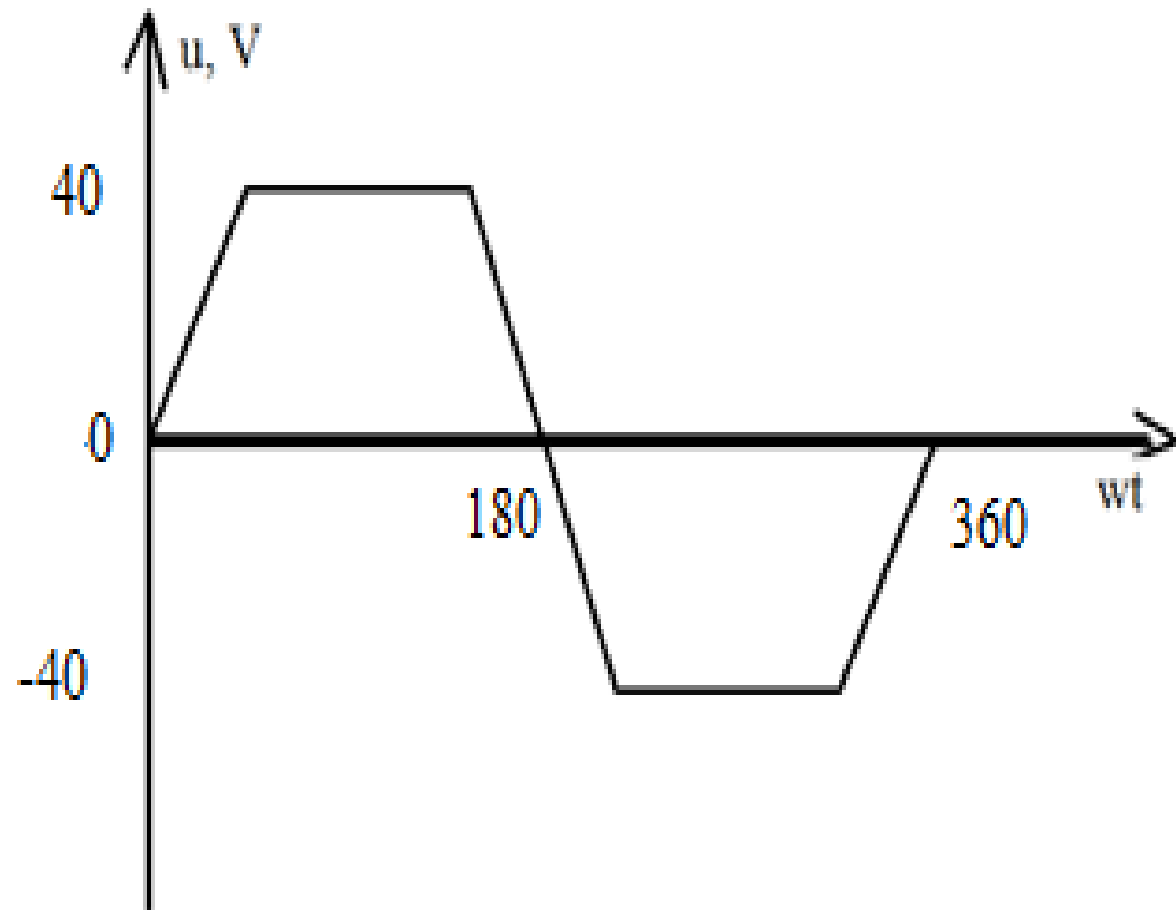
(C) The voltage measurements are converted to binary numbers.



(D) The numbers are stored on the recording medium.

Masala

1. Rasmda keltirilgan $f(\omega t)$ funktsiyaning birinchi, uchinchi va beshinchi garmonikalari aniqlansin.



Egri chiziq absissa o'qiga nisbatan simmetrik bo'lgani uchun Fure qatorining tarkibida uning doimiy tashkil etuvchisi bo'lmaydi, ya'ni $A_0 = 0$ va qator faqat toq garmonikalardan iborat bo'ladi.

Sinus va kosinus tashkil etuvchilari birinchi garmonikalarining amplitudalari mos ravishda quyidagi formulalar bilan aniqlanadi:

$$A'_{1m} = \frac{2}{n} \sum_{p=1}^{p=n} f_p(x) \cdot \sin\left(p \frac{2\pi}{n}\right)$$

$$A'_{1m} = \frac{2 \cdot 2}{24} (20 \cdot \sin(15^\circ) + 40 \cdot \sin(30^\circ) + 40 \cdot \sin(45^\circ) + 40 \cdot \sin(60^\circ) + 40 \cdot \sin(75^\circ) + 40 \cdot \sin(90^\circ))$$

$$A''_{1m} = \frac{4}{24} \sum_{p=1}^{12} f_p(x) \cdot \cos\left(p \frac{2\pi}{n}\right) = 0,078$$

Birinchi garmonika amplitudasi

$$A_{1m} = \sqrt{(A'_1)^2 + (A''_1)^2} = 48,9392$$

boshlang'ich fazasi esa

$$\Psi_1 = \arctg \frac{A''_{1m}}{A'_{1m}} = 0,09$$

Uchinchi garmonika sinus tashkil etuvchisining amplitudasi:

$$A'_{3m} = \frac{4}{24} \sum_{p=1}^{12} f_p(x) \cdot \sin 3x = 11,3$$

Uchinchi garmonika kosinus tashkil etuvchisining amplitudasi:

$$A''_{3m} = \frac{4}{24} \sum_{p=1}^{12} f_p(x) \cdot \cos 3x = 0,054$$

Uchinchi garmonika amplitudasi va boshlang'ich fazasi

$$A_{3m} = \sqrt{(A'_3)^2 + (A''_3)^2} = 11,36$$

$$\psi_3 = \arctg \frac{A''_{3m}}{A'_{3m}} = 0,27$$

Beshinchi garmonika sinus tashkil etuvchisining amplitudasi:

$$A'_{5m} = \frac{4}{24} \sum_{p=1}^{12} f_p(x) \cdot \sin 5x = 2,22$$

Beshinchi garmonika kosinus tashkil etuvchisining amplitudasi:

$$A''_{5m} = \frac{4}{24} \sum_{p=1}^{12} f_p(x) \cdot \cos 5x = 0,0176$$

Beshinchi garmonika amplitudasi va boshlang'ich fazasi

$$A_{5m} = \sqrt{(A'_5)^2 + (A''_5)^2} = 2,2233$$

$$\psi_5 = \arctg \frac{A''_{5m}}{A'_{5m}} = 0,91$$

Demak beshinchi garmonika bilan chegaralangan Fure qarorini quyidagicha yozamiz:

$$f(\omega t) = A_{1m} \cdot \sin(\omega t + \Psi_1) + A_{3m} \cdot \sin(3\omega t + \Psi_3) + A_{5m} \cdot \sin(5\omega t + \Psi_5) =$$

$$= 48,9393 \sin(\omega t + 0,091^0) + 11,36 \sin(3\omega t + 0,27^0) + 2,223 \sin(5\omega t + 0,91^0)$$

Quyidagi rasmda birinchi, uchinchi va beshinchi garmonikalarning grafigi va ularning yig'indisidan hosil bo'lgan umumiy nosinusoidal funktsiya keltirilgan.

