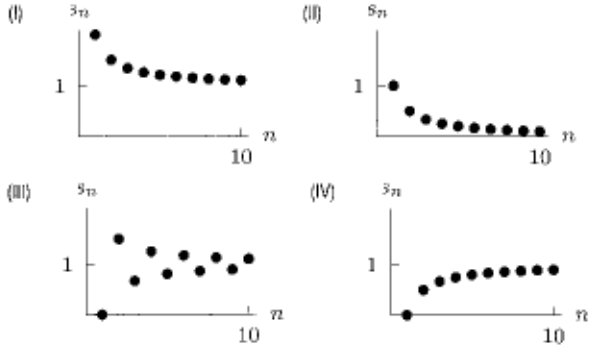
Problems

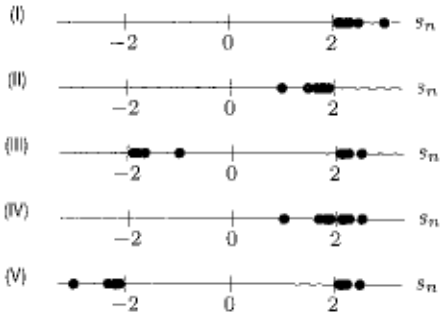
17. Match formulas (a)–(d) with graphs (I)–(IV).

(a) $s_n = 1 - 1/n$ **(b)** $s_n = 1 + (-1)^n/n$
(c) $s_n = 1/n$ **(d)** $s_n = 1 + 1/n$



18. Match formulas (a)–(e) with graphs (I)–(V).

(a) $s_n = 2 - 1/n$
(b) $s_n = (-1)^n 2 + 1/n$
(c) $s_n = 2 + (-1)^n/n$
(d) $s_n = 2 + 1/n$
(e) $s_n = (-1)^n 2 + (-1)^n/n$



19. Match formulas (a)–(e) with descriptions (I)–(V) of the behavior of the sequence as $n \to \infty$.

(a) $s_n = n(n+1) - 1$
(b) $s_n = 1/(n+1)$
(c) $s_n = 1 - n^2$
(d) $s_n = \cos(1/n)$
(e) $s_n = (\sin n)/n$

(I) Diverges to $-\infty$
(II) Diverges to $+\infty$
(III) Converges to 0 through positive numbers
(IV) Converges to 1
(V) Converges to 0 through positive and negative numbers

[3] www.bp.com, accessed May 28, 2004.

Do the sequences in Problems 20–31 converge or diverge? If a sequence converges, find its limit.

20. $(0.2)^n$ **21.** 2^n

22. $(-0.3)^n$ **23.** $3 + e^{-2n}$

24. $\dfrac{2^n}{3^n}$ **25.** $\dfrac{n}{10} + \dfrac{10}{n}$

26. $\dfrac{(-1)^n}{n}$ **27.** $\dfrac{2n+1}{n}$

28. $\cos(\pi n)$ **29.** $\dfrac{\sin n}{n}$

30. $\dfrac{2n + (-1)^n 5}{4n - (-1)^n 3}$ **31.** $\dfrac{2^n}{n^3}$

In electrical engineering, a continuous function like $f(t) = \sin t$, where t is time in seconds, is referred to as an analog signal. To digitize the signal, we sample $f(t)$ every Δt seconds to form the sequence $s_n = f(n\Delta t)$. For example, sampling f every $1/10$ second produces the sequence $\sin(1/10)$, $\sin(2/10)$, $\sin(3/10)$, . . . In Problems 32–34, give the first 6 terms of a sampling of the signal every Δt seconds.

32. $f(t) = \cos 5t$, $\Delta t = 0.1$

33. $f(t) = (x-1)^2$, $\Delta t = 0.5$

34. $f(t) = \dfrac{\sin t}{t}$, $\Delta t = 1$

To smooth a sequence, $s_1, s_2, s_3, \ldots$, we replace each term s_n by t_n, the average of s_n with its neighboring terms:

$$t_n = \frac{(s_{n-1} + s_n + s_{n+1})}{3} \text{ for } n > 1.$$

We start with $t_1 = (s_1 + s_2)/2$, since s_1 has only one neighbor. For Problems 35–37, smooth the sequence once and then smooth the resulting sequence. What do you notice?

35. 18, −18, 18, −18, 18, −18, 18

36. 0, 0, 0, 18, 0, 0, 0, 0

37. 1, 2, 3, 4, 5, 6, 7, 8

38. Let V_n be the number of new SUVs sold in the US in month n, where $n = 1$ is January 2004. In terms of SUVs, what do the following represent?

(a) V_{10}
(b) $V_n - V_{n-1}$
(c) $\sum_{i=1}^{12} V_i$ and $\sum_{i=1}^{n} V_i$