

References

The references collected here are those of general usefulness, usually cited in more than one section of this book. More specialized sources, usually cited in a single section, are not repeated here.

We first list a small number of books that form the nucleus of a recommended personal reference collection on numerical methods, numerical analysis, and closely related subjects. These are the books that we like to have within easy reach.

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We next list the larger collection of books, which, in our view, should be included in any serious research library on computing, numerical methods, or analysis.

- Bevington, P.R. 1969, *Data Reduction and Error Analysis for the Physical Sciences* (New York: McGraw-Hill)
- Bloomfield, P. 1976, *Fourier Analysis of Time Series – An Introduction* (New York: Wiley)
- Bowers, R.L., and Wilson, J.R. 1991, *Numerical Modeling in Applied Physics and Astrophysics* (Boston: Jones & Bartlett)
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Index of Programs and Dependencies

The following table lists, in alphabetical order, all the routines in *Numerical Recipes*. When a routine requires subsidiary routines, either from this book or else user-supplied, the full dependency tree is shown: A routine calls directly all routines to which it is connected by a solid line in the column immediately to its right; it calls indirectly the connected routines in all columns to its right. Typographical conventions: Routines from this book are in typewriter font (e.g., `eu1sum`, *gamm1n*). The smaller, slanted font is used for the second and subsequent occurrences of a routine in a single dependency tree. (When you are getting routines from the *Numerical Recipes* diskettes, or their archive files, you need only specify names in the larger, upright font.) User-supplied routines are indicated by the use of text font and square brackets, e.g., [funcv]. Consult the text for individual specifications of these routines. The right-hand side of the table lists section and page numbers for each program.

addint	— interp		§19.6 (p. 871)
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	└─ bessjy	└─ beschb	— chebev
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		└─ ran1	
	└─ [funk]		
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	└─ [funk]		
amotry	— [funk]		§10.4 (p. 405)
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	└─ metrop	— ran3	
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	└─ revcst		
	└─ revers		
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— qrdcmp	
— qrupdt — rotate	
— rsolv	
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dftint	[func]		§13.9 (p. 581)
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	└─ polint		
	└─ dftcor		
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drealft		DOUBLE PRECISION version of realft, q.v.	
dspr sax		DOUBLE PRECISION version of spr sax, q.v.	
dspr stx		DOUBLE PRECISION version of spr stx, q.v.	
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fit	—	gammq	—	gser	—	gcf	—	gammln	§15.2 (p. 659)				
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	—	mnbrak											
	—	brent											
	—	gammq	—	gser	—	gcf	—	gammln					
	—	zbrent	—	chixy									
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gammq	└─ gser ─┐ └─ gcf ─┐ gammln	§6.2 (p. 211)
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gaujac	— gammln	§4.5 (p. 148)
gaulag	— gammln	§4.5 (p. 146)
gauleg		§4.5 (p. 145)
gaussj		§2.1 (p. 30)
gcf	— gammln	§6.2 (p. 212)
golden	— [func]	§10.1 (p. 394)
gser	— gammln	§6.2 (p. 212)
hpsel	— sort	§8.5 (p. 336)
hpsort		§8.3 (p. 329)
hqr		§11.6 (p. 484)
hufapp		§20.4 (p. 899)
hufdec		§20.4 (p. 900)
hufenc		§20.4 (p. 900)
hufmak	— hufapp	§20.4 (p. 898)
hunt		§3.4 (p. 112)
hypdrv		§6.12 (p. 265)
hypgeo	└─ hypser └─ odeint ── bsstep ── mmid └─ hypdrv ── pzextr	§6.12 (p. 264)
hypser		§6.12 (p. 264)
icrc	— icrc1	§20.3 (p. 893)
icrc1		§20.3 (p. 892)
igray		§20.2 (p. 888)
iindexx		INTEGER version of indexx, q.v.
indexx		§8.4 (p. 330)
interp		§19.6 (p. 871)
irbit1		§7.4 (p. 288)
irbit2		§7.4 (p. 290)
jacobi		§11.1 (p. 460)
jacobn		§16.6 (p. 734)
julday		§1.1 (p. 13)
kendl1	— erfcc	§14.6 (p. 638)
kendl2	— erfcc	§14.6 (p. 639)
kermom		§18.3 (p. 792)

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ks2d1s	quadct	§14.7 (p. 642)
	—quadvl	
	—pearsn—betai—gammln	
	—betacf	
	—probks	
ks2d2s	quadct	§14.7 (p. 643)
	—pearsn—betai—gammln	
	—betacf	
	—probks	
ksone	sort	§14.3 (p. 619)
	—[func]	
	—probks	
kstwo	sort	§14.3 (p. 619)
	—probks	
laguer		§9.5 (p. 366)
lfit	[funcs]	§15.4 (p. 668)
	—gaussj	
	—covsrt	
linbcg	atimes	§2.7 (p. 79)
	—snrm	
	—asolve	
linmin	mnbrak	§10.5 (p. 412)
	—brent—f1dim—[func]	
lnsrch	[func]	§9.7 (p. 378)
locate		§3.4 (p. 111)
lop		§19.6 (p. 879)
lubksb		§2.3 (p. 39)
ludcmp		§2.3 (p. 38)
machar		§20.1 (p. 884)
maloc		§19.6 (p. 873)
matadd		§19.6 (p. 879)
matsub		§19.6 (p. 879)
medfit	rofunc—select	§15.7 (p. 699)
memcof		§13.6 (p. 561)
metrop	ran3	§10.9 (p. 443)
mgfas	maloc	§19.6 (p. 877)
	—rstrct	
	—slvsm2—fill0	
	—interp	
	—copy	
	—relax2	
	—lop	
	—matsub	

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		anorm2		
		matadd		
mglin		maloc	§19.6 (p. 869)	
		rstrct		
		slvsml — fill0		
		interp		
		copy		
		relax		
		resid		
		fill0		
		addint — interp		
midinf	— [func]		§4.4 (p. 138)	
midpnt	— [func]		§4.4 (p. 136)	
miser		ranpt — ran1	§7.8 (p. 316)	
		[func]		
mmid	— [derivs]		§16.3 (p. 717)	
mnbrak	— [func]		§10.1 (p. 393)	
mnewt		[usrfun]	§9.6 (p. 374)	
		ludcmp		
		lubksb		
moment			§14.1 (p. 607)	
mp2dfr	— mpops		§20.6 (p. 913)	
mpdiv		mpinv		
			mpmul — drealft — dfour1 . .	§20.6 (p. 911)
			mpops	
			mpmul — drealft — dfour1	
			mpops	
mpinv		mpmul — drealft — dfour1	§20.6 (p. 911)	
		mpops		
mpmul	— drealft — dfour1		§20.6 (p. 910)	
mpops			§20.6 (p. 907)	
mppi		mpsqrtr		
			mpmul — drealft — dfour1 . .	§20.6 (p. 913)
			mpops	
		mpops		
		mpmul — drealft — dfour1		
		mpinv — mpmul — drealft — dfour1		
		mp2dfr — mpops		
mprove	— lubksb		§2.5 (p. 48)	
mpsqrtr		mpmul — drealft — dfour1	§20.6 (p. 912)	
		mpops		
mrqcof	— [funcs]		§15.5 (p. 681)	
mrqmin		mrqcof — [funcs]	§15.5 (p. 680)	
		gaussj		
		covsrt		

newt	fmin		§9.7 (p. 379)
	fdjac	[funcv]	
	ludcmp		
	lubksb		
	lnsrch	fmin — [funcv]	
odeint	[derivs]		§16.2 (p. 714)
	rkqs	[derivs]	
		rkck — [derivs]	
orthog			§4.5 (p. 153)
pade	ludcmp		§5.12 (p. 196)
	lubksb		
	mprove	lubksb	
pccheb			§5.11 (p. 193)
pcshift			§5.10 (p. 192)
pearsn	betai	gammln	§14.5 (p. 632)
		betacf	
period	avevar		§13.8 (p. 572)
piksr2			§8.1 (p. 322)
piksrt			§8.1 (p. 321)
pinvs			§17.3 (p. 762)
plgndr			§6.8 (p. 247)
poidev	ran1		§7.3 (p. 284)
		gammln	
polcoe			§3.5 (p. 114)
polcof	polint		§3.5 (p. 115)
poldiv			§5.3 (p. 169)
polin2	polint		§3.6 (p. 118)
polint			§3.1 (p. 103)
powell	[func]		§10.5 (p. 411)
	linmin	mnbrak	
		brent — f1dim — [func]	
predic			§13.6 (p. 562)
probks			§14.3 (p. 620)
psdes			§7.5 (p. 293)
pwt			§13.10 (p. 589)
pwtset			§13.10 (p. 589)
pythag			§2.6 (p. 62)
pzextr			§16.4 (p. 724)
qgaus	[func]		§4.5 (p. 141)
qrdcmp			§2.10 (p. 92)

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qromb	└ trapzd — [func]		§4.3 (p. 134)
	└ polint		
qromo	└ midpnt — [func]		§4.4 (p. 137)
	└ polint		
qroot	— poldiv		§9.5 (p. 371)
qrsolv	— rsolv		§2.10 (p. 93)
qrupdt	— rotate		§2.10 (p. 94)
qsimp	— trapzd — [func]		§4.2 (p. 133)
qtrap	— trapzd — [func]		§4.2 (p. 131)
quad3d	— qgaus	└ [func]	§4.6 (p. 157)
		└ [y1]	
		└ [y2]	
		└ [z1]	
		└ [z2]	
quadct			§14.7 (p. 642)
quadmx	— wwghts — kermom		§18.3 (p. 793)
quadvl			§14.7 (p. 643)
ran0			§7.1 (p. 270)
ran1			§7.1 (p. 271)
ran2			§7.1 (p. 272)
ran3			§7.1 (p. 273)
ran4	— psdes		§7.5 (p. 294)
rank			§8.4 (p. 333)
ranpt	— ran1		§7.8 (p. 318)
ratint			§3.2 (p. 106)
ratlsq	└ [fn]		§5.13 (p. 200)
	└ dsvdcmp — dpythag		
	└ dsvbksb		
	└ ratval		
ratval			§5.3 (p. 170)
rc			§6.11 (p. 259)
rd			§6.11 (p. 257)
realft	— four1		§12.3 (p. 507)
rebin			§7.8 (p. 314)
red			§17.3 (p. 763)
relax			§19.6 (p. 872)
relax2			§19.6 (p. 878)
resid			§19.6 (p. 872)
revcst			§10.9 (p. 441)
revers			§10.9 (p. 442)
rf			§6.11 (p. 257)

rkj	└─ rc	§6.11 (p. 258)
	└─ rf	
rk4	— [derivs]	§16.1 (p. 706)
rkck	— [derivs]	§16.2 (p. 713)
rkdumb	└─ [derivs]	§16.1 (p. 707)
	└─ rk4 — [derivs]	
rkqs	— rkck — [derivs]	§16.2 (p. 712)
rlft3	— four	§12.5 (p. 522)
rofunc	— select	§15.7 (p. 700)
rotate		§2.10 (p. 95)
rsolv		§2.10 (p. 93)
rstrct		§19.6 (p. 870)
rtbis	— [func]	§9.1 (p. 347)
rtflsp	— [func]	§9.2 (p. 349)
rtnewt	— [funcd]	§9.4 (p. 358)
rtsafe	— [funcd]	§9.4 (p. 359)
rtsec	— [func]	§9.2 (p. 350)
rzextr		§16.4 (p. 725)
savgol	└─ ludcmp	§14.8 (p. 646)
	└─ lubksb	
scrsho	— [func]	§9.0 (p. 342)
select		§8.5 (p. 334)
selip	— shell	§8.5 (p. 335)
sfroid	└─ plgndr	§17.4 (p. 768)
	└─ solvde └─ difeq	
		└─ pinvs
		└─ red
		└─ bksub
shell		§8.1 (p. 323)
shoot	└─ [load]	§17.1 (p. 750)
	└─ odeint └─ [derivs]	
		└─ rkqs — rkck — [derivs]
	└─ [score]	
shootf	└─ [load1]	§17.2 (p. 752)
	└─ odeint └─ [derivs]	
		└─ rkqs — rkck — [derivs]
	└─ [score]	
	└─ [load2]	
simpl		§10.8 (p. 434)
simp2		§10.8 (p. 434)
simp3		§10.8 (p. 435)

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simplx	— simp1		§10.8 (p. 432)
	— simp2		
	— simp3		
simpr	— ludcmp		§16.6 (p. 736)
	— lubksb		
	— [derivs]		
sinft	— realft — four1		§12.3 (p. 511)
slvsm2	— fill0		§19.6 (p. 878)
slvsml	— fill0		§19.6 (p. 872)
sncndn			§6.11 (p. 262)
snrm			§2.7 (p. 81)
sobseq			§7.7 (p. 302)
solvde	— difeq		§17.3 (p. 760)
	— pinvs		
	— red		
	— bksub		
sor			§19.5 (p. 860)
sort			§8.2 (p. 324)
sort2			§8.2 (p. 326)
sort3	— indexx		§8.4 (p. 332)
spctrm	— four1		§13.4 (p. 550)
spear	— sort2		§14.6 (p. 635)
	— crank		
	— erfcc		
	— betai — gammln		
		— betacf	
sphbes	— bessjy — beschb — chebev		§6.7 (p. 245)
sphfpt	— newt — fdjac — shootf (q.v.)		§17.4 (p. 772)
		— lnsrch — shootf (q.v.)	
		— fmin — shootf (q.v.)	
		— ludcmp	
		— lubksb	
sphoot	— newt — fdjac — shoot (q.v.)		§17.4 (p. 771)
		— lnsrch — shoot (q.v.)	
		— fmin — shoot (q.v.)	
		— ludcmp	
		— lubksb	
splie2	— spline		§3.6 (p. 121)
splin2	— splint		§3.6 (p. 121)
	— spline		
spline			§3.3 (p. 109)
splint			§3.3 (p. 110)
spread			§13.8 (p. 576)

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spr sax		§2.7 (p. 72)
spr sin		§2.7 (p. 72)
spr spm		§2.7 (p. 75)
spr stm		§2.7 (p. 76)
spr stp	— iindexx	§2.7 (p. 73)
spr stx		§2.7 (p. 73)
stif bs	— jacobn	§16.6 (p. 737)
	— simpr — ludcmp	
	— lubksb	
	— [derivs]	
	— pzextr	
stiff	— jacobn	§16.6 (p. 732)
	— ludcmp	
	— lubksb	
	— [derivs]	
stoerm	— [derivs]	§16.5 (p. 726)
svb ksb		§2.6 (p. 56)
svd cmp	— pythag	§2.6 (p. 59)
svd fit	— [funcs]	§15.4 (p. 672)
	— svd cmp — pythag	
	— svb ksb	
svd var		§15.4 (p. 673)
toe plz		§2.8 (p. 88)
tp test	— avevar	§14.2 (p. 612)
	— betai — gammln	
	— betacf	
tqli	— pythag	§11.3 (p. 473)
trap zd	— [func]	§4.2 (p. 131)
tred 2		§11.2 (p. 467)
trid ag		§2.4 (p. 43)
trnc st		§10.9 (p. 442)
trns pt		§10.9 (p. 442)
tt est	— avevar	§14.2 (p. 610)
	— betai — gammln	
	— betacf	
tut est	— avevar	§14.2 (p. 611)
	— betai — gammln	
	— betacf	
two fft	— four1	§12.3 (p. 505)
vander		§2.8 (p. 84)

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vegas	└─ rebin	§7.8 (p. 311)
	└─ ran2	
	└─ [fxn]	
voltra	└─ [g]	§18.2 (p. 787)
	└─ [ak]	
	└─ ludcmp	
	└─ lubksb	
wt1	— daub4	§13.10 (p. 587)
wtm	— daub4	§13.10 (p. 595)
wgths	— kermom	§18.3 (p. 791)
zbrac	— [func]	§9.1 (p. 345)
zbrak	— [func]	§9.1 (p. 345)
zbrent	— [func]	§9.3 (p. 354)
zrhqr	└─ balanc	§9.5 (p. 368)
	└─ hqr	
zridr	— [func]	§9.2 (p. 351)
zroots	— laguer	§9.5 (p. 367)