

()

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(// / : // / :)

()

(REML)

DFREML

(h_m)

() / () /
) / () / (h_m)

() / (c) (

h_m **c** () /

/ (**am**) / / /

REML

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()
) ()
) ()
) ()

- y = Xb + Z₁a + e (M1)
- y = Xb + Z₁a + Wc + e (M2)
- y = Xb + Z₁a + Z₂m + e (M3)
- Cov_{am} = 0 (M3)
- y = Xb + Z₁a + Z₂m + e (M4)
- Cov_{am} ≠ 0 (M4)
- y = Xb + Z₁a + Z₂m + Wc + e (M7)
- Cov_{am} = 0 (M7)
- y = Xb + Z₁a + Z₂m + Wc + e (M8)
- Cov_{am} ≠ 0 (M8)

a y
 m c
 Z₁ X e W Z₂ (BW8W)
 () (EW) (EN)
 () (ASM)

Cov_{am} ()

(EN)	(EW)	(BW8W) (ASM)	(DP)
ASM ()	DP ()	EN ()	EW ()
			BW8W ()
/	/	/	/
/ (/)	/ (/)	/ (/)	/ (/)
/	/	/	/
			/
			/

...
 :
) () /
 () ()
 ((h_a^2)
 ($p < /$) (h_m^2)
 / / / (c^2)
 / / (r_{am})
) (REML)
 () DFREML
 () Simplex (LogL)^r
 / /
 ($p < /$)
 (/)
 / /
 $\chi^2 = -2(\text{LogL}_{M_i} - \text{LogL}_{M_j})$
 χ^2
 $\text{LogL}_{M_j} \quad \text{LogL}_{M_i}$
 ()
 i j
 ($p > /$)
 ($p < /$)
 / / / $r_{am} \quad c \quad h_m^2 \quad h_a^2$ ()
 /
 () / /
 ()
 ($p < /$) /
 ()
 ($p < /$)

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1. Derivative Free Algorithm
 2. Log Likelihood

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$h_m c^2$ /

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($P < /$)

($P < /$)

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/ (/)

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/ $r_{am} c h_m h_a$ /

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LogL	r_{am}	h_m^2	c^2	h_a^2	σ_p^2	σ_e^2	σ_{am}	σ_m^2	σ_c^2	σ_a^2
/				/ \pm /	/	/				/
/			/ \pm /	/ \pm /	/	/			/	/
/		/ \pm /		/ \pm /	/	/		/		/
/	/	/ \pm /		/ \pm /	/	/	/	/		/
/		/ \pm /	/ \pm /	/ \pm /	/	/		/	/	/
/	/	/ \pm /	/ \pm /	/ \pm /	/	/	/	/	/	/

σ_{am}

σ_m^2

σ_c^2

σ_a^2 *

c^2

h_a^2

σ_p^2

σ_e^2

LogL

r_{am}

h_m^2

()

-

LogL	r_{am}	h_m^2	c^2	h_a^2	σ_p^2	σ_e^2	σ_{am}	σ_m^2	σ_c^2	σ_a^2
/				/ \pm /	/	/				/
/			/ \pm /	/ \pm /	/	/			/	/
/		/ \pm /		/ \pm /	/	/		/		/
/	/	/ \pm /		/ \pm /	/	/	/	/		/
/		/ \pm /	/ \pm /	/ \pm /	/	/		/	/	/
/	/	/ \pm /	/ \pm /	/ \pm /	/	/	/	/	/	/

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LogL	r_{am}	h_m^2	c^2	h_a^2	σ_p^2	σ_e^2	σ_{am}	σ_m^2	σ_c^2	σ_a^2
/				/ ± /	/	/				/
/			/ ± /	/ ± /	/	/			/	/
/		/ ± /		/ ± /	/	/		/		/
/	/	/ ± /		/ ± /	/	/	/	/		/
/		/ ± /	/ ± /	/ ± /	/	/		/	/	/
/	/	/ ± /	/ ± /	/ ± /	/	/	/	/	/	/

()

()

(P < /)

/ / c h_a () ()

h_m h_a / /

/ /

h_m c

(/)

(P < /)

(P < /)

()

() ()

()

()

(P < /)

/ / r_{am} c h_m h_a

/ /

()

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(/)

(

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)

() (

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r_{am} c h_m h_a

/ /

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() :

LogL	r_{am}	h_m^2	c^2	h_a^2	σ_p^2	σ_e^2	σ_{am}	σ_m^2	σ_c^2	σ_a^2
/				/ ± /	/	/				/
/			/ ± /	/ ± /	/	/			/	/
/	/ ± /			/ ± /	/	/		/		/
/	/ ± /			/ ± /	/	/	/	/		/
/	/ ± /	/ ± /	/ ± /	/ ± /	/	/		/	/	/
/	/ ± /	/ ± /	/ ± /	/ ± /	/	/	/	/	/	/

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(.)

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$e^2 h_m$

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