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JMMC

How To Compute Uniform-Disk Diameters From Limb-Darkened Diameters ?

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CHANGE RECORD

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	Title typo correction.		
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	Added tables containing linear darkening coefficients for bands U, B, V, L et N ; Added explanation in section 1 on diamUD that will be computed in bands B, V, R, L, N ; Added links to new appendix tables in section 4 ; Added a new paragraph in section 5 to further discuss spectral types.		
2.2	14/01/2010	D. Bonneau	Section 3, 5, 6 and appendices
	Removed K mag limit in section 3 Detailed luminosity class conversion in section 5.1 Added I band case in section 5.3 Fixed coefficient values and results in section 6.3 Fixed title (UR replaced by U) in appendix 5		

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1 Introduction

In SearchCal, the potential calibrators selected near a science target are characterized by their angular diameter. The latter is calculated with a surface brightness method, more precisely using the color-magnitude relation V - (V-K) which has the lowest dispersion (Bonneau et al., 2006, A & A, 456.789).

In the catalog of calibrators created by SearchCal the θ_{VK} diameter given for each star thus corresponds to the limb-darkened disk diameter (θ_{LD}) independent of the wavelength.

In the list of calibrators provided to the user, ESO prefers to have explicitly the uniform disk angular diameters (θ_{UD}) for each band used for observations with the VLTI instrument AMBER (J-band, H-band and K-band), θ_{UD} [J], θ_{UD} [H] and θ_{UD} [K].
Within the framework of the preparation of instrument MATISSE of the VLTI, it appears useful to also calculate the diameters θ_{UD} [L] and θ_{UD} [N].
Interferometric observations being also realized at visible wavelengths (in particular with instrument VEGA on CHARA), the uniform diameters θ_{UD} [B], θ_{UD} [V] and θ_{UD} [R] can be also calculated.

This requires implementing an automated method of conversion of θ_{LD} to θ_{UD} [λ] when creating the list of calibrators from the JMMC catalog provided by SearchCal.

This conversion will be done with the hypothesis of a linear limb darkening.

2 Principle

Starting with SearchCal limb-darkened estimate:

$$\theta_{LD} = \theta_{VK}$$

A correction factor $\rho_\theta[\lambda] = \theta_{LD} / \theta_{UD}[\lambda]$ shall be applied to obtain $\theta_{UD}[\lambda]$.

According to Hanbury Brown et al. (1974, MNRAS, 167, 475):

$$\rho_\theta[\lambda] = [(1 - u_\lambda/3)/(1 - 7u_\lambda/15)]^{1/2}$$

where u_λ is the linear darkening coefficient obtained by the adjustment of the radial intensity distribution on the stellar disk, as a function of the wavelength, using a stellar atmosphere model characterized by the effective temperature (T_{eff}), the gravity (log g) and the metallicity ([Fe/H]).

The value of the UD diameter at λ will be:

$$\theta_{UD}[\lambda] = \theta_{LD} / \rho_\theta[\lambda]$$

The error on $\theta_{UD}[\lambda]$ induced by this method is estimated in the section 6.

3 Determining Teff and log g from Spectral Type

For bright calibrators, SearchCal give the spectral type as the temperature class [O, B, A, F, G, K, M] and the luminosity class [supergiants (I), giants (II, III) and main sequence (IV, V)].

As first approximation, values of T_{eff} and log g can be obtained as a function of the temperature class for normal stars of « Main sequence », « Giants » and « Supergiants » from the tables in Allen's Astrophysical Quantities (Ed. A. N. Cox, 1999, hereafter AQ):

- Table 15.7 for T_{eff}
- Table 15.8 for log $g/g_\odot$

AQ tables can be interpolated for the intermediate values of the temperature classes.

If the luminosity class is unknown, by default one can suppose that the star is a giant (III).
The bias introduced by this assumption is estimated in the section 6.

4 Data on limb-darkening

The linear limb-darkening coefficients in the U, B and V bands have been computed by Díaz-Cordovés, Claret and Gimenez (1995, A&AS, 110, 329)
The linear limb-darkening coefficients in the R, I, J, H and K bands have been computed by Claret, Díaz-Cordovés and Gimenez (1995, A&AS, 114, 247).
The linear limb-darkening coefficients in the L and N bands have been computed by van Hamme (1993, AJ, 106, 2096).
This authors have used the ATLAS stellar atmosphere models by Kurucz (1991, Harvard Preprint 3348) for a large domain of values of temperature T_{eff} = 3500 to 50000 K by 250 K steps and for surface gravities g [cm s^{-2}] log g = 0.0 to 5.0 with 0.50 steps and a solar chemical composition.

The values for u[U], u[B] and u[V] are can be taken from table 1 in Claret et al. paper at CDS (reference J/A+AS/110/329/table1).
See APPENDIX 5 "Table Díaz-Cordovés" in this document

The values for u[R], u[I], u[J], u[H] and u[K] are taken from table 1 in Díaz-Cordovés et al. paper at CDS (reference J/A+AS/114/247/table1).
See APPENDIX 4 "Table Claret" in this document.

The values for u[L] and u[N] are taken from table 2 in van Hamme paper at CDS (reference J/AJ/106/2096/table2).
See APPENDIX 6 "Van Hamme" in this document.

5 Conversion of θ_{LD} to $\theta_{UD}[\lambda]$

5.1 Use of the spectral type

From SearchCal's spectral type one gets:

- The temperature class [O, B, A, F, G, K, M] and sub class [0,1,2,3,4,5,6,7,8,9]

- The luminosity class [I, II, III, IV, V] and sub class.

The **temperature classes** are converted in a numerical scale:

- O5 to O9 → 1 to 5
- B0 to B9 → 6 to 15
- A0 to A9 → 16 to 25
- F0 to F8 → 26 to 34
- G0 to G9 → 35 to 44
- K0 to K7 → 45 to 52
- M0 to M8 → 53 to 61

The **luminosity classes** are converted in a numerical scale:

- Ia-O, Ia-O/Ia, Ia, Ia/ab, Iab, Iab-b, Ib, Ib-II → 1
- II, II/III, III, III/IV → 2
- IV, IV/V, V, V/VI, VI → 3

See also the document "an encoding system to represent stellar spectral classes in archival database and cataolgs":
http://www.ivoa.net/Documents/latest/SpectClasses.html

5.2 Extraction of T_{eff} and log g

- The value of the effective temperature T_{eff} is interpolated from Table AQ.15.7 according to the temperature and luminosity codes defined above.
- The value of the relative gravity log $g/g_\odot$ is interpolated from Table AQ.15.8 according to the temperature and luminosity codes defined above.
- Taking for the Sun, log $g_\odot$ = 4.378 cm s^{-2} (AQ, 340/14 SUN), one has the surface gravity :

$$\log g\ [\mathrm{cm\ s^{-2}}] = \log g/g_\odot + 4.378$$

5.3 How to compute the diameters $\theta_{UD}[I]$, $\theta_{UD}[J]$, $\theta_{UD}[H]$ and $\theta_{UD}[K]$

- T_{eff} and log g are used to get u[I], u[J], u[H] and u[K] from ClaretTable.
- Correction factors $\rho_\theta[I]$, $\rho_\theta[J]$, $\rho_\theta[H]$ and $\rho_\theta[K]$ are obtained using Hanbury Brown et al. Formula.
- Uniform disk diameters are thus :

$$\theta_{UD}[I] = \theta_{VK} / \rho_\theta[I],\ \ \theta_{UD}[J] = \theta_{VK} / \rho_\theta[J],$$
$$\theta_{UD}[H] = \theta_{VK} / \rho_\theta[H] \text{ and } \theta_{UD}[K] = \theta_{VK} / \rho_\theta[K]$$

5.4 How to compute the diameters $\theta_{UD}[B]$, $\theta_{UD}[V]$ and $\theta_{UD}[R]$

- T_{eff} and log g are used to get u[B], u[V] and u[R] from "Table Díaz-Cordovés" and "Table Claret" respectively.
- Correction factors $\rho_\theta[B]$, $\rho_\theta[V]$ and $\rho_\theta[R]$ are obtained using Hanbury Brown et al. Formula.
- Uniform disk diameters are thus :

$$\theta_{UD}[B] = \theta_{VK} / \rho_\theta[B],\ \ \theta_{UD}[V] = \theta_{VK} / \rho_\theta[V] \text{ and } \theta_{UD}[R] = \theta_{VK} / \rho_\theta[R]$$

5.5 How to compute the diameters θ_{UD}[L] and θ_{UD}[N]

- T_{eff} and log g are used to get ***u*[L]** and ***u*[N]** from the "Table van Hamme"..
- Correction factors **ρ_θ[L]** and **ρ_θ[N]** are obtained using Hanbury Brown et al. Formula.
- Uniform disk diameters are thus :
  θ_{UD}[L] = θ_{VK} / ρ_θ[L] and **θ_{UD}[N] = θ_{VK} / ρ_θ[N]**

Warning:
A star having a circumstellar dusty disc or envelope must be rejected as a bad calibrator because the computation of the photometric diameter can be biased by the circumstellar radiation.
Such an object is revealed by a photometry presenting a strong infrared excess.
These objects are among evolved stars (like M type giant and super giants or B[e] stars) and among young stellar objects of any spectral type.

6 Tests and Examples

6.1 HD 199947

SpType K3III cut in:
⇒ Temperature class: K3 = 48
⇒ Luminosity class: III = 2
Diam_vk = θ_{LD} = 1.185 ± 0.082 mas

1- Temperature and gravity.
From table 2 one gets with numSp = 48:
⇒ Teff = 4250 K
⇒ Log g/g⊙ = -2.4 i.e., log g = 1.98

2- Limb-Darkening coefficients.
In Claret's table with Teff = 4250 K and log g = 1.98 one gets:
For [|(4250 – Teff)| ≤ 125] ⇒ Teff = 4250 K
For [|(1.98 – log g)| ≤0.25] ⇒ log g = 2.00
For Teff = 4250 K and log g = 2.00 one gets:
the coefficients u(J) = 0.501, u(H) = 0.418 and u(K) = 0.354

3- Uniform-Disk diameters.
u(J) = 0.501 ⇒ ρ_θ[J] = 1.043 ⇒ θ_{UD}[J] = 1.136 mas
u(H) = 0.418 ⇒ ρ_θ[H] = 1.034 ⇒ θ_{UD}[H] = 1.146 mas
u(K) = 0.354 ⇒ ρ_θ[K] = 1.028 ⇒ θ_{UD}[K] = 1.153 mas

This star is in the Mérand's catalog (Mérand et al. 2005, A&A 433, 1155)**:**
TypSp = K3 III

θ_{LD} = 1.215 mas	$\theta_{LD} - \theta_{VK}$ = 0.030 mas
Θ_{UD}[J] = 1.161	$\Delta\theta$[J] = 0.025 mas
Θ_{UD}[H] = 1.178	$\Delta\theta$[H] = 0.032 mas
Θ_{UD}[K] = 1.183 ± 0.016	$\Delta\theta$[K] = 0.030 mas

6.2 HD 188154

SpType K5 III cut in:

⇒ Temperature class K5 = 50

⇒ Luminosity class III = 2

Diam_vk = θ_{LD} = 2.604 ± 0.18 mas

1- Temperature and gravity.

From table 2 one gets with numSp = 50:

⇒ Teff = 4050 K

⇒ Log g/g⊙ = -2.70 i.e. log g = 1.68

2- Limb-Drakening coefficients.

In Claret's table with Teff = 4050 K and log g = 1.68 one gets:

For [|(4050 – Teff)| ≤ 125] ⇒ Teff = 4000 K

For [|(1.68 – log g)| ≤0.25] ⇒ log g = 1.50

For Teff = 4000 K and log g = 1.50 one gets:

the coefficients u(J) = 0.520, u(H) = 0.441 and u(K) = 0.370

3-Uniform-Disk diameters.

u(J) = 0.520 ⇒ ρ_θ[J] = 1.041 ⇒ θ_{UD}[J] = 2.492 mas

u(H) = 0.441 ⇒ ρ_θ[H] = 1.036 ⇒ θ_{UD}[H] = 2.513 mas

u(K) = 0.370 ⇒ ρ_θ[K] = 1.029 ⇒ θ_{UD}[K] = 2.530 mas

This star is in the Bordé's catalog (Bordé et al. 2002, A&A 393,183)**:**

typSp = K5 III , Teff = 4046 K, log g = 1.93

θ_{LD} = 2.52 ± 0.28 mas	$\theta_{LD} - \theta_{VK}$ = -0.084 mas
u[J] = 0.506 Θ_{UD}[J] = 2.42	Δθ[J] = -0.072 mas
u[H] = 0.433 Θ_{UD}[H] = 2.43	Δθ[J] = -0.083 mas
u[K] = 0.367 Θ_{UD}[JK] = 2.45	Δθ[J] = -0.080 mas

6.3 HD178524

SpType F2II/ III cut in:

⇒ Temperature class F2 = 28

⇒ Luminosity class II ou III = 2

Diam_vk = θ_{LD} = 1.754 ± 0.121 mas

1- Temperature and gravity.

From table 2 one gets with numSp = 28:

⇒ Teff = 6500 K

⇒ Log g/g⊙ = -1.25 i.e. log g = 3.13

2- Limb-Drakening coefficients.

In Claret's table with Teff = 6500 K and log g = 3.13 one gets:

For [|(6500 – Teff)| ≤ 125] ⇒ Teff = 6500 K

For [|(3.13 – log g)| ≤0.25] ⇒ log g = 3.00

For Teff = 6500 K and log g = 3.00 one gets:

the coefficients u(J) = 0.314, u(H) = 0.245 et u(K) = 0.217

3-Uniform-Disk diameters.
u(J) = 0.314 ⇒ ρ_θ[J] = 1.024 ⇒ θ_{UD}[J] = 1.712 mas
u(H) = 0.245 ⇒ ρ_θ[H] = 1.018 ⇒ θ_{UD}[H] = 1.723 mas
u(K) = 0.217 ⇒ ρ_θ[K] = 1.016 ⇒ θ_{UD}[K] = 1.726 mas

Bias due to uncertainty on the luminosity class
Taking the temperature class F2 = 28
The luminosity class is supposed to be unknown

1) Assuming a **"supergiant" luminosity class I = 1**
In Table 1 we get: Teff = 7030 K and log g/g⊙ = -2.9
In Table "Claret" then we get Teff = 7000 and log g = 1.5
And we obtain:
u(J) = 0.328 ⇒ θ_{UD}[J] = 1.710 mas
u(H) = 0.264 ⇒ θ_{UD}[H] = 1.720 mas
u(K) = 0.223 ⇒ θ_{UD}[K] = 1.726 mas

2) Assuming a "**dwarf" luminosity class V = 3**
In Table 3 we get: Teff = 7000 K and log g/g⊙ = -0.10
In Table "Claret" then we get Teff = 7000 and log g = 4.5
And we obtain:
u(J) = 0.302 ⇒ θ_{UD}[J] = 1.714 mas
u(H) = 0.239 ⇒ θ_{UD}[H] = 1.723 mas
u(K) = 0.212 ⇒ θ_{UD}[K] = 1.727 mas

The comparison of these values of θ_{UD} with these obtained using the true luminosity class of this star shows a difference always < 0.012 mas.

6.4 Estimate of the uncertainty on θ_{UD} given the choice of Teff and log g parameters

- If the temperature class and luminosity class are known:
Various trails show that:

- Taking log g ± 0.5 the change in diameter value is $\Delta\theta \leq 0.001$ mas
- Taking T_{eff} ± 250K the change in diameter value is $\Delta\theta \leq 0.005$ mas

- If the luminosity class is unknown, the choice of the class III seems to be reasonable.

The uncertainty on the limb-darkened diameter dominates the whole transformations.
There is no need to interpolate Claret's table for all practical purposes.

APPENDIX 1: Tables of T_{eff} and log $g/g_\odot$ for Dwarfs

The initial values of this table are those of Tables 15.7 (T_{eff}) and 15.8 (log $g/g_\odot$) in Allen's AQ (1999). Additional values have been added by interpolation to fill the empty ranges in the parent table.

Table 3

Sp	numSp	Teff	log g/gs
O5	1	42000	-0,40
O6	2	41000	-0,45
O7	3	39000	-0,50
O8	4	37000	-0,50
O9	5	34000	-0,50
B0	6	30000	-0,50
B1	7	24000	-0,50
B2	8	20900	-0,50
B3	9	19000	-0,50
B4	10	17500	-0,45
B5	11	15200	-0,40
B6	12	14000	-0,40
B7	13	12500	-0,40
B8	14	11400	-0,40
B9	15	10500	-0,35
A0	16	9790	-0,30
A1	17	9500	-0,25
A2	18	9000	-0,20
A3	19	8600	-0,20
A4	20	8400	-0,15
A5	21	8180	-0,15
A6	22	7750	-0,15
A7	23	7600	-0,15
A8	24	7500	-0,10
A9	25	7350	-0,10
F0	26	7300	-0,10
F1	27	7150	-0,10
F2	28	7000	-0,10
F3	29	6900	-0,10
F4	30	6800	-0,10
F5	31	6650	-0,10
F6	32	6500	-0,05
F7	33	6200	-0,05
F8	34	6250	-0,05
G0	35	5940	-0,05
G1	36	5900	0,00
G2	37	5790	0,00
G3	38	5700	0,00
G4	39	5650	0,00
G5	40	5560	0,05
G6	41	5500	0,05
G7	42	5300	0,05
G8	43	5310	0,05
G9	44	5250	0,05
K0	45	5150	0,05
K1	46	4800	0,10
K2	47	4830	0,10
K3	48	4700	0,10
K4	49	4550	0,10
K5	50	4410	0,10
K6	51	4200	0,15
K7	52	4000	0,15
M0	53	3840	0,15
M1	54	3700	0,20
M2	55	3520	0,25
M3	56	3400	0,30
M4	57	3300	0,40
M5	58	3170	0,50

APPENDIX 2: Table of T_{eff} and log $g/g_\odot$ for Giants

The initial values of this table are those of Tables 15.7 (T_{eff}) and 15.8 (log $g/g_\odot$) in Allen's AQ (1999). Additional values have been added by interpolation to fill the empty ranges in the parent table.
For T_{eff} some values have been added by extrapolation for stars hotter than G5.

Table 2

Sp	numSp	Teff	log g/gs
O5	1		
O6	2		
O7	3		
O8	4		
O9	5	32000	
B0	6	26000	-1,10
B1	7	23000	-1,00
B2	8	20000	-1,00
B3	9	17000	-1,00
B4	10	15500	-1,00
B5	11	14000	-0,95
B6	12	13000	-1,00
B7	13	12000	-1,00
B8	14	11100	-1,00
B9	15	10500	-1,00
A0	16	9980	-1,00
A1	17	9600	-1,00
A2	18	9380	-1,00
A3	19	9000	-1,00
A4	20	8750	-1,05
A5	21	8500	-1,10
A6	22	8250	-1,10
A7	23	8000	-1,10
A8	24	7600	-1,10
A9	25	7400	-1,20
F0	26	7000	-1,20
F1	27	6750	-1,20
F2	28	6500	-1,25
F3	29	6300	-1,30
F4	30	6100	-1,30
F5	31	6000	-1,35
F6	32	5900	-1,40
F7	33	5800	-1,40
F8	34	5700	-1,45
G0	35	5600	-1,50
G1	36	5500	-1,50
G2	37	5400	-1,60
G3	38	5250	-1,70
G4	39	5150	-1,80
G5	40	5050	-1,90
G6	41	4950	-2,00
G7	42	4900	-2,10
G8	43	4800	-2,15
G9	44	4700	-2,20
K0	45	4660	-2,30
K1	46	4500	-2,30
K2	47	4390	-2,35
K3	48	4250	-2,40
K4	49	4150	-2,50
K5	50	4050	-2,70
K6	51	3950	-2,80
K7	52	3850	-2,95
M0	53	3690	-3,10
M1	54	3600	-3,30
M2	55	3540	-3,55
M3	56	3500	-3,75
M4	57	3400	-4,10
M5	58	3380	-4,50

APPENDIX 3: Table of T_{eff} and log $g/g_\odot$ for Super Giants

The initial values of this table are those of Tables 15.7 (T_{eff}) and 15.8 (log $g/g_\odot$) in Allen's AQ (1999). Additional values have been added by interpolation to fill the empty ranges in the parent table.

Table 1

Sp	numSp	Teff	log g/gs
O5	1		-1,1
O6	2		-1,2
O7	3		-1,2
O8	4		-1,2
O9	5	32000	-1,4
B0	6	26000	-1,6
B1	7	21000	-1,7
B2	8	17600	-1,8
B3	9	15500	-1,9
B4	10	14500	-2,0
B5	11	13600	-2,0
B6	12	12500	-2,1
B7	13	11700	-2,2
B8	14	11100	-2,2
B9	15	10500	-2,3
A0	16	9980	-2,3
A1	17	9600	-2,3
A2	18	9380	-2,3
A3	19	9000	-2,4
A4	20	8750	-2,4
A5	21	8610	-2,4
A6	22	8250	-2,5
A7	23	8150	-2,6
A8	24	7900	-2,6
A9	25	7600	-2,7
F0	26	7460	-2,7
F1	27	7300	-2,8
F2	28	7030	-2,9
F3	29	6950	-2,9
F4	30	6750	-2,9
F5	31	6370	-3,0
F6	32	6250	-3,0
F7	33	6150	-3,0
F8	34	5750	-3,0
G0	35	5370	-3,1
G1	36	5250	-3,2
G2	37	5190	-3,2
G3	38	5100	-3,2
G4	39	4970	-3,3
G5	40	4930	-3,3
G6	41	4800	-3,3
G7	42	4750	-3,4
G8	43	4700	-3,4
G9	44	4600	-3,5
K0	45	4550	-3,5
K1	46	4400	-3,6
K2	47	4310	-3,7
K3	48	4250	-3,8
K4	49	4100	-4,0
K5	50	3990	-4,1
K6	51	3800	-4,2
K7	52	3700	-4,3
M0	53	3620	-4,3
M1	54	3500	-4,4
M2	55	3370	-4,5
M3	56	3250	-4,6
M4	57	3000	-4,7
M5	58	2880	-4,8

APPENDIX 4: Table of u_θ[R], u_θ[I], u_θ[J], u_θ[H] and u_θ[K]

Table Claret

No	logg cm/s²	Teff K	u(R)	u(I)	u(J)	u(H)	u(K)
1	0.00	3500	0.853	0.726	0.529	0.482	0.399
2	0.50	3500	0.842	0.713	0.518	0.478	0.395
3	1.00	3500	0.827	0.701	0.509	0.475	0.393
4	1.50	3500	0.812	0.688	0.503	0.472	0.391
5	2.00	3500	0.796	0.677	0.498	0.470	0.389
6	2.50	3500	0.782	0.667	0.494	0.465	0.386
7	3.00	3500	0.768	0.657	0.481	0.454	0.376
8	3.50	3500	0.741	0.631	0.421	0.396	0.324
9	4.00	3500	0.699	0.593	0.355	0.300	0.247
10	4.50	3500	0.666	0.565	0.320	0.248	0.207
11	5.00	3500	0.644	0.545	0.305	0.229	0.192
12	0.00	3750	0.816	0.694	0.541	0.465	0.387
13	0.50	3750	0.816	0.691	0.534	0.463	0.386
14	1.00	3750	0.815	0.688	0.528	0.462	0.384
15	1.50	3750	0.811	0.684	0.521	0.460	0.383
16	2.00	3750	0.806	0.679	0.516	0.458	0.382
17	2.50	3750	0.800	0.674	0.510	0.456	0.381
18	3.00	3750	0.792	0.667	0.505	0.452	0.378
19	3.50	3750	0.774	0.653	0.487	0.440	0.368
20	4.00	3750	0.721	0.610	0.426	0.391	0.322
21	4.50	3750	0.657	0.557	0.359	0.308	0.254
22	5.00	3750	0.615	0.521	0.321	0.253	0.212
23	0.00	4000	0.774	0.660	0.527	0.442	0.372
24	0.50	4000	0.775	0.658	0.525	0.441	0.370
25	1.00	4000	0.775	0.656	0.523	0.441	0.370
26	1.50	4000	0.775	0.655	0.520	0.441	0.370
27	2.00	4000	0.775	0.654	0.517	0.440	0.370
28	2.50	4000	0.774	0.654	0.514	0.440	0.370
29	3.00	4000	0.773	0.653	0.511	0.439	0.371
30	3.50	4000	0.771	0.651	0.507	0.436	0.369
31	4.00	4000	0.751	0.635	0.488	0.425	0.358
32	4.50	4000	0.690	0.585	0.431	0.384	0.318
33	5.00	4000	0.618	0.525	0.366	0.315	0.261
34	0.00	4250	0.741	0.635	0.499	0.417	0.354
35	0.50	4250	0.742	0.632	0.501	0.417	0.353
36	1.00	4250	0.741	0.630	0.501	0.417	0.352
37	1.50	4250	0.741	0.628	0.501	0.418	0.353
38	2.00	4250	0.740	0.627	0.501	0.418	0.354
39	2.50	4250	0.740	0.627	0.501	0.419	0.356
40	3.00	4250	0.740	0.627	0.501	0.420	0.357
41	3.50	4250	0.740	0.627	0.499	0.420	0.358
42	4.00	4250	0.739	0.627	0.497	0.418	0.357
43	4.50	4250	0.722	0.613	0.482	0.408	0.347
44	5.00	4250	0.666	0.566	0.433	0.376	0.314
45	0.00	4500	0.707	0.611	0.468	0.392	0.335
46	0.50	4500	0.709	0.609	0.471	0.392	0.333
47	1.00	4500	0.710	0.608	0.473	0.392	0.333
48	1.50	4500	0.711	0.607	0.475	0.393	0.334
49	2.00	4500	0.711	0.606	0.478	0.395	0.336
50	2.50	4500	0.711	0.605	0.480	0.397	0.339
51	3.00	4500	0.711	0.605	0.481	0.398	0.340
52	3.50	4500	0.712	0.605	0.482	0.400	0.342
53	4.00	4500	0.711	0.605	0.482	0.400	0.343
54	4.50	4500	0.711	0.605	0.481	0.400	0.343
55	5.00	4500	0.699	0.595	0.470	0.392	0.335
56	0.00	4750	0.673	0.585	0.441	0.368	0.316
57	0.50	4750	0.678	0.587	0.445	0.368	0.316
58	1.00	4750	0.679	0.585	0.447	0.368	0.315
59	1.50	4750	0.681	0.585	0.450	0.370	0.317
60	2.00	4750	0.682	0.584	0.452	0.372	0.318
61	2.50	4750	0.683	0.585	0.455	0.374	0.321
62	3.00	4750	0.685	0.585	0.458	0.376	0.323
63	3.50	4750	0.686	0.585	0.460	0.379	0.326
64	4.00	4750	0.686	0.586	0.462	0.381	0.328
65	4.50	4750	0.687	0.586	0.463	0.382	0.329
66	5.00	4750	0.687	0.586	0.463	0.382	0.329
67	0.00	5000	0.637	0.551	0.413	0.343	0.296
68	0.50	5000	0.642	0.555	0.418	0.343	0.296
69	1.00	5000	0.647	0.558	0.422	0.345	0.298
70	1.50	5000	0.649	0.558	0.424	0.347	0.299
71	2.00	5000	0.651	0.559	0.427	0.349	0.301
72	2.50	5000	0.654	0.561	0.431	0.352	0.304
73	3.00	5000	0.656	0.563	0.434	0.355	0.306
74	3.50	5000	0.658	0.564	0.437	0.358	0.309
75	4.00	5000	0.660	0.566	0.440	0.361	0.312
76	4.50	5000	0.662	0.567	0.443	0.364	0.315
77	5.00	5000	0.663	0.568	0.444	0.365	0.315
78	0.00	5250	0.604	0.516	0.388	0.321	0.278
79	0.50	5250	0.610	0.522	0.393	0.320	0.277
80	1.00	5250	0.614	0.525	0.397	0.322	0.279
81	1.50	5250	0.618	0.530	0.401	0.325	0.282
82	2.00	5250	0.620	0.532	0.404	0.328	0.284
83	2.50	5250	0.623	0.535	0.407	0.331	0.287
84	3.00	5250	0.626	0.538	0.411	0.334	0.290
85	3.50	5250	0.630	0.541	0.414	0.338	0.294
86	4.00	5250	0.633	0.544	0.418	0.342	0.297
87	4.50	5250	0.636	0.546	0.421	0.345	0.300
88	5.00	5250	0.638	0.548	0.423	0.347	0.301
89	0.00	5500	0.620	0.520	0.398	0.334	0.285
90	0.50	5500	0.574	0.484	0.364	0.297	0.255
91	1.00	5500	0.579	0.490	0.369	0.298	0.257
92	1.50	5500	0.583	0.496	0.374	0.301	0.261
93	2.00	5500	0.587	0.501	0.379	0.305	0.265
94	2.50	5500	0.592	0.506	0.383	0.309	0.269
95	3.00	5500	0.597	0.511	0.388	0.314	0.273
96	3.50	5500	0.602	0.516	0.393	0.319	0.278
97	4.00	5500	0.606	0.520	0.397	0.323	0.282
98	4.50	5500	0.608	0.523	0.400	0.327	0.284
99	5.00	5500	0.611	0.526	0.402	0.329	0.286
100	0.00	5750	0.604	0.501	0.384	0.326	0.275
101	0.50	5750	0.607	0.502	0.384	0.317	0.268
102	1.00	5750	0.554	0.464	0.348	0.279	0.239
103	1.50	5750	0.555	0.467	0.351	0.280	0.241
104	2.00	5750	0.559	0.473	0.356	0.284	0.246
105	2.50	5750	0.566	0.480	0.363	0.289	0.252
106	3.00	5750	0.570	0.486	0.367	0.294	0.257
107	3.50	5750	0.575	0.492	0.372	0.300	0.263
108	4.00	5750	0.579	0.497	0.377	0.305	0.267
109	4.50	5750	0.582	0.501	0.380	0.310	0.271
110	5.00	5750	0.585	0.503	0.383	0.313	0.273
111	0.00	6000	0.588	0.485	0.375	0.322	0.272
112	0.50	6000	0.592	0.486	0.371	0.307	0.259
113	1.00	6000	0.594	0.488	0.372	0.303	0.256
114	1.50	6000	0.535	0.446	0.332	0.262	0.226
115	2.00	6000	0.538	0.451	0.337	0.266	0.230
116	2.50	6000	0.541	0.456	0.342	0.271	0.236
117	3.00	6000	0.546	0.463	0.348	0.276	0.241
118	3.50	6000	0.550	0.469	0.353	0.282	0.247
119	4.00	6000	0.554	0.474	0.358	0.288	0.252
120	4.50	6000	0.557	0.478	0.361	0.293	0.256
121	5.00	6000	0.559	0.481	0.363	0.296	0.259
122	0.50	6250	0.578	0.472	0.361	0.302	0.254
123	1.00	6250	0.581	0.473	0.360	0.293	0.247
124	1.50	6250	0.582	0.475	0.361	0.290	0.247
125	2.00	6250	0.521	0.433	0.321	0.251	0.218
126	2.50	6250	0.522	0.436	0.325	0.254	0.222
127	3.00	6250	0.526	0.442	0.330	0.260	0.228
128	3.50	6250	0.529	0.448	0.335	0.266	0.234
129	4.00	6250	0.533	0.454	0.340	0.272	0.239
130	4.50	6250	0.535	0.458	0.344	0.277	0.243
131	5.00	6250	0.536	0.461	0.346	0.282	0.246
132	0.50	6500	0.566	0.460	0.354	0.300	0.251
133	1.00	6500	0.569	0.460	0.348	0.285	0.240
134	1.50	6500	0.571	0.462	0.349	0.280	0.237
135	2.00	6500	0.571	0.464	0.352	0.280	0.239
136	2.50	6500	0.509	0.422	0.311	0.242	0.213
137	3.00	6500	0.509	0.425	0.314	0.245	0.217
138	3.50	6500	0.512	0.431	0.320	0.251	0.222

139	4.00	6500	0.514	0.435	0.325	0.257	0.226
140	4.50	6500	0.516	0.440	0.328	0.263	0.231
141	5.00	6500	0.516	0.442	0.331	0.268	0.234
142	0.50	6750	0.557	0.454	0.352	0.301	0.253
143	1.00	6750	0.557	0.447	0.340	0.280	0.235
144	1.50	6750	0.558	0.448	0.338	0.271	0.229
145	2.00	6750	0.559	0.451	0.339	0.269	0.229
146	2.50	6750	0.558	0.453	0.341	0.270	0.231
147	3.00	6750	0.497	0.412	0.303	0.236	0.210
148	3.50	6750	0.496	0.414	0.306	0.238	0.212
149	4.00	6750	0.499	0.420	0.311	0.245	0.217
150	4.50	6750	0.500	0.424	0.314	0.250	0.221
151	5.00	6750	0.500	0.427	0.318	0.256	0.224
152	0.50	7000	0.550	0.451	0.354	0.305	0.256
153	1.00	7000	0.546	0.439	0.335	0.278	0.234
154	1.50	7000	0.546	0.435	0.328	0.264	0.223
155	2.00	7000	0.547	0.437	0.327	0.259	0.220
156	2.50	7000	0.546	0.440	0.329	0.259	0.221
157	3.00	7000	0.545	0.442	0.332	0.261	0.224
158	3.50	7000	0.486	0.403	0.296	0.230	0.206
159	4.00	7000	0.486	0.406	0.299	0.234	0.209
160	4.50	7000	0.486	0.410	0.302	0.239	0.212
161	5.00	7000	0.487	0.414	0.306	0.246	0.216
162	0.50	7250	0.543	0.451	0.358	0.311	0.260
163	1.00	7250	0.536	0.433	0.333	0.278	0.233
164	1.50	7250	0.534	0.426	0.321	0.260	0.219
165	2.00	7250	0.534	0.424	0.317	0.251	0.214
166	2.50	7250	0.534	0.426	0.317	0.249	0.213
167	3.00	7250	0.533	0.429	0.320	0.250	0.215
168	3.50	7250	0.531	0.432	0.323	0.253	0.218
169	4.00	7250	0.474	0.393	0.287	0.225	0.202
170	4.50	7250	0.474	0.397	0.291	0.229	0.205
171	5.00	7250	0.475	0.402	0.295	0.236	0.209
172	0.50	7500	0.537	0.455	0.366	0.321	0.267
173	1.00	7500	0.525	0.428	0.331	0.280	0.234
174	1.50	7500	0.521	0.416	0.315	0.258	0.217
175	2.00	7500	0.520	0.412	0.308	0.246	0.209
176	2.50	7500	0.520	0.411	0.306	0.240	0.206
177	3.00	7500	0.520	0.415	0.308	0.240	0.206
178	3.50	7500	0.519	0.419	0.311	0.242	0.209
179	4.00	7500	0.517	0.422	0.313	0.246	0.212
180	4.50	7500	0.464	0.386	0.281	0.222	0.199
181	5.00	7500	0.464	0.390	0.285	0.227	0.202
182	1.00	7750	0.516	0.426	0.332	0.283	0.235
183	1.50	7750	0.508	0.408	0.311	0.256	0.215
184	2.00	7750	0.504	0.400	0.300	0.241	0.204
185	2.50	7750	0.504	0.398	0.295	0.233	0.200
186	3.00	7750	0.504	0.399	0.295	0.230	0.199
187	3.50	7750	0.506	0.405	0.299	0.231	0.200
188	4.00	7750	0.505	0.410	0.302	0.234	0.203
189	4.50	7750	0.502	0.413	0.304	0.240	0.207
190	5.00	7750	0.455	0.381	0.276	0.221	0.198
191	1.00	8000	0.510	0.428	0.336	0.289	0.239
192	1.50	8000	0.497	0.402	0.308	0.255	0.213
193	2.00	8000	0.490	0.390	0.293	0.237	0.200
194	2.50	8000	0.488	0.385	0.287	0.227	0.194
195	3.00	8000	0.488	0.385	0.284	0.222	0.192
196	3.50	8000	0.489	0.388	0.285	0.221	0.192
197	4.00	8000	0.492	0.396	0.290	0.224	0.195
198	4.50	8000	0.491	0.402	0.294	0.229	0.199
199	5.00	8000	0.449	0.374	0.271	0.217	0.194
200	1.00	8250	0.504	0.433	0.345	0.301	0.248
201	1.50	8250	0.489	0.400	0.307	0.257	0.213
202	2.00	8250	0.478	0.382	0.288	0.234	0.197
203	2.50	8250	0.473	0.374	0.279	0.222	0.189
204	3.00	8250	0.472	0.371	0.274	0.215	0.185
205	3.50	8250	0.472	0.373	0.274	0.212	0.185
206	4.00	8250	0.475	0.379	0.276	0.214	0.186
207	4.50	8250	0.478	0.388	0.282	0.219	0.190
208	5.00	8250	0.477	0.394	0.285	0.225	0.194
209	1.50	8500	0.483	0.400	0.309	0.261	0.215
210	2.00	8500	0.470	0.378	0.286	0.233	0.194
211	2.50	8500	0.461	0.366	0.273	0.218	0.184
212	3.00	8500	0.457	0.360	0.266	0.209	0.179
213	3.50	8500	0.457	0.360	0.264	0.205	0.178
214	4.00	8500	0.458	0.363	0.264	0.204	0.178
215	4.50	8500	0.461	0.371	0.268	0.208	0.181
216	5.00	8500	0.464	0.381	0.275	0.215	0.186
217	1.50	8750	0.479	0.402	0.313	0.266	0.218
218	2.00	8750	0.463	0.376	0.285	0.234	0.194
219	2.50	8750	0.452	0.360	0.269	0.216	0.181
220	3.00	8750	0.446	0.352	0.261	0.205	0.175
221	3.50	8750	0.443	0.349	0.256	0.199	0.172
222	4.00	8750	0.443	0.350	0.255	0.196	0.171
223	4.50	8750	0.444	0.355	0.256	0.198	0.172
224	5.00	8750	0.450	0.366	0.262	0.204	0.177
225	1.50	9000	0.475	0.403	0.317	0.272	0.224
226	2.00	9000	0.458	0.374	0.285	0.236	0.195
227	2.50	9000	0.446	0.357	0.267	0.215	0.180
228	3.00	9000	0.438	0.346	0.257	0.202	0.172
229	3.50	9000	0.433	0.341	0.250	0.195	0.167
230	4.00	9000	0.431	0.340	0.247	0.191	0.166
231	4.50	9000	0.431	0.342	0.247	0.190	0.166
232	5.00	9000	0.433	0.347	0.247	0.192	0.167
233	2.00	9250	0.453	0.373	0.286	0.238	0.196
234	2.50	9250	0.440	0.354	0.266	0.215	0.179
235	3.00	9250	0.431	0.342	0.254	0.201	0.170
236	3.50	9250	0.425	0.336	0.247	0.192	0.164
237	4.00	9250	0.421	0.333	0.242	0.187	0.162
238	4.50	9250	0.420	0.333	0.240	0.185	0.161
239	5.00	9250	0.420	0.337	0.240	0.186	0.161
240	2.00	9500	0.448	0.372	0.286	0.239	0.197
241	2.50	9500	0.435	0.352	0.265	0.215	0.178
242	3.00	9500	0.425	0.339	0.252	0.200	0.168
243	3.50	9500	0.418	0.331	0.244	0.190	0.162
244	4.00	9500	0.414	0.328	0.238	0.184	0.159
245	4.50	9500	0.411	0.327	0.235	0.181	0.157
246	5.00	9500	0.410	0.328	0.233	0.180	0.156
247	2.00	9750	0.443	0.369	0.286	0.240	0.198
248	2.50	9750	0.429	0.349	0.263	0.215	0.178
249	3.00	9750	0.419	0.336	0.249	0.199	0.167
250	3.50	9750	0.413	0.328	0.241	0.189	0.160
251	4.00	9750	0.407	0.323	0.235	0.182	0.156
252	4.50	9750	0.404	0.321	0.231	0.178	0.154
253	5.00	9750	0.402	0.322	0.229	0.177	0.153
254	2.00	10000	0.437	0.366	0.285	0.240	0.198
255	2.50	10000	0.423	0.345	0.261	0.214	0.177
256	3.00	10000	0.414	0.332	0.247	0.198	0.165
257	3.50	10000	0.407	0.324	0.238	0.187	0.158
258	4.00	10000	0.402	0.319	0.232	0.180	0.154
259	4.50	10000	0.398	0.317	0.228	0.176	0.152
260	5.00	10000	0.395	0.317	0.225	0.174	0.150
261	2.00	10500	0.427	0.359	0.281	0.238	0.196
262	2.50	10500	0.411	0.337	0.257	0.211	0.175
263	3.00	10500	0.402	0.324	0.242	0.195	0.162
264	3.50	10500	0.395	0.316	0.233	0.184	0.155
265	4.00	10500	0.391	0.312	0.227	0.177	0.150
266	4.50	10500	0.387	0.309	0.223	0.172	0.148
267	5.00	10500	0.384	0.309	0.219	0.169	0.146
268	2.50	11000	0.399	0.328	0.250	0.206	0.171
269	3.00	11000	0.389	0.315	0.236	0.190	0.158
270	3.50	11000	0.383	0.308	0.227	0.180	0.151
271	4.00	11000	0.380	0.304	0.222	0.173	0.147
272	4.50	11000	0.376	0.301	0.217	0.168	0.144
273	5.00	11000	0.373	0.301	0.214	0.165	0.142
274	2.50	11500	0.388	0.320	0.244	0.201	0.167
275	3.00	11500	0.376	0.305	0.229	0.184	0.154
276	3.50	11500	0.371	0.298	0.220	0.175	0.147
277	4.00	11500	0.368	0.295	0.215	0.169	0.142
278	4.50	11500	0.366	0.293	0.212	0.164	0.140
279	5.00	11500	0.363	0.293	0.209	0.162	0.138
280	2.50	12000	0.380	0.313	0.240	0.198	0.163
281	3.00	12000	0.365	0.296	0.222	0.179	0.149
282	3.50	12000	0.358	0.289	0.213	0.169	0.142
283	4.00	12000	0.356	0.286	0.209	0.163	0.138
284	4.50	12000	0.355	0.285	0.206	0.160	0.136
285	5.00	12000	0.353	0.285	0.203	0.158	0.134
286	2.50	12500	0.374	0.308	0.236	0.195	0.161
287	3.00	12500	0.356	0.289	0.217	0.175	0.145
288	3.50	12500	0.348	0.280	0.207	0.164	0.137
289	4.00	12500	0.344	0.276	0.202	0.158	0.133
290	4.50	12500	0.344	0.276	0.199	0.155	0.131

291	5.00	12500	0.343	0.277	0.198	0.153	0.130
292	2.50	13000	0.369	0.305	0.234	0.193	0.159
293	3.00	13000	0.349	0.283	0.212	0.171	0.142
294	3.50	13000	0.338	0.272	0.201	0.159	0.133
295	4.00	13000	0.334	0.268	0.196	0.153	0.129
296	4.50	13000	0.333	0.268	0.193	0.150	0.127
297	5.00	13000	0.334	0.269	0.192	0.149	0.126
298	2.00	14000	0.413	0.356	0.284	0.242	0.200
299	2.50	14000	0.364	0.303	0.232	0.192	0.158
300	3.00	14000	0.338	0.275	0.206	0.166	0.138
301	3.50	14000	0.324	0.261	0.192	0.153	0.128
302	4.00	14000	0.318	0.255	0.186	0.145	0.123
303	4.50	14000	0.315	0.253	0.183	0.142	0.120
304	5.00	14000	0.315	0.255	0.182	0.141	0.120
305	2.50	15000	0.363	0.303	0.233	0.192	0.159
306	3.00	15000	0.332	0.270	0.202	0.163	0.135
307	3.50	15000	0.314	0.253	0.186	0.148	0.124
308	4.00	15000	0.305	0.245	0.178	0.139	0.118
309	4.50	15000	0.301	0.242	0.174	0.135	0.115
310	5.00	15000	0.300	0.242	0.173	0.134	0.114
311	2.50	16000	0.365	0.307	0.236	0.195	0.161
312	3.00	16000	0.328	0.268	0.201	0.162	0.134
313	3.50	16000	0.307	0.248	0.182	0.145	0.121
314	4.00	16000	0.296	0.238	0.172	0.135	0.114
315	4.50	16000	0.290	0.233	0.167	0.130	0.111
316	5.00	16000	0.288	0.233	0.165	0.129	0.109
317	2.50	17000	0.370	0.314	0.242	0.201	0.166
318	3.00	17000	0.326	0.268	0.200	0.162	0.135
319	3.50	17000	0.302	0.244	0.179	0.143	0.119
320	4.00	17000	0.289	0.232	0.168	0.132	0.111
321	4.50	17000	0.282	0.227	0.162	0.127	0.107
322	5.00	17000	0.278	0.225	0.159	0.124	0.106
323	2.50	18000	0.378	0.324	0.252	0.210	0.174
324	3.00	18000	0.326	0.270	0.202	0.164	0.136
325	3.50	18000	0.298	0.242	0.178	0.142	0.118
326	4.00	18000	0.283	0.228	0.165	0.130	0.109
327	4.50	18000	0.275	0.222	0.158	0.124	0.105
328	5.00	18000	0.271	0.219	0.155	0.121	0.103
329	2.50	19000	0.386	0.335	0.264	0.222	0.185
330	3.00	19000	0.328	0.273	0.205	0.167	0.139
331	3.50	19000	0.296	0.242	0.177	0.142	0.119
332	4.00	19000	0.279	0.226	0.163	0.129	0.108
333	4.50	19000	0.269	0.218	0.155	0.122	0.103
334	5.00	19000	0.264	0.214	0.151	0.119	0.101
335	3.00	20000	0.330	0.277	0.209	0.172	0.144
336	3.50	20000	0.295	0.242	0.178	0.143	0.120
337	4.00	20000	0.275	0.224	0.161	0.128	0.108
338	4.50	20000	0.265	0.215	0.153	0.121	0.102
339	5.00	20000	0.259	0.211	0.149	0.117	0.100
340	3.00	21000	0.331	0.281	0.214	0.177	0.149
341	3.50	21000	0.294	0.243	0.180	0.145	0.123
342	4.00	21000	0.273	0.223	0.161	0.129	0.109
343	4.50	21000	0.261	0.212	0.151	0.120	0.102
344	5.00	21000	0.255	0.208	0.146	0.116	0.099
345	3.00	22000	0.332	0.284	0.218	0.182	0.155
346	3.50	22000	0.293	0.244	0.182	0.149	0.126
347	4.00	22000	0.271	0.223	0.162	0.131	0.111
348	4.50	22000	0.258	0.211	0.151	0.121	0.103
349	5.00	22000	0.251	0.206	0.145	0.116	0.099
350	3.00	23000	0.335	0.288	0.222	0.187	0.159
351	3.50	23000	0.291	0.244	0.183	0.151	0.129
352	4.00	23000	0.269	0.223	0.163	0.133	0.114
353	4.50	23000	0.256	0.210	0.152	0.123	0.105
354	5.00	23000	0.248	0.204	0.145	0.117	0.101
355	3.00	24000	0.343	0.295	0.229	0.193	0.164
356	3.50	24000	0.290	0.244	0.184	0.153	0.132
357	4.00	24000	0.266	0.222	0.164	0.135	0.116
358	4.50	24000	0.253	0.210	0.152	0.124	0.107
359	5.00	24000	0.246	0.203	0.146	0.119	0.103
360	3.00	25000	0.353	0.306	0.238	0.201	0.170
361	3.50	25000	0.290	0.245	0.186	0.155	0.133
362	4.00	25000	0.263	0.220	0.164	0.136	0.118
363	4.50	25000	0.250	0.209	0.153	0.126	0.109
364	5.00	25000	0.243	0.203	0.146	0.121	0.105
365	3.00	26000	0.364	0.318	0.249	0.211	0.178
366	3.50	26000	0.293	0.248	0.188	0.157	0.135
367	4.00	26000	0.261	0.220	0.164	0.137	0.119
368	4.50	26000	0.247	0.207	0.153	0.127	0.111
369	5.00	26000	0.240	0.201	0.147	0.122	0.106
370	3.50	27000	0.297	0.253	0.192	0.160	0.137
371	4.00	27000	0.261	0.220	0.165	0.137	0.119
372	4.50	27000	0.244	0.206	0.153	0.127	0.111
373	5.00	27000	0.237	0.200	0.147	0.123	0.107
374	3.50	28000	0.301	0.257	0.196	0.163	0.139
375	4.00	28000	0.262	0.221	0.166	0.138	0.120
376	4.50	28000	0.242	0.205	0.152	0.127	0.111
377	5.00	28000	0.234	0.198	0.146	0.122	0.106
378	3.50	29000	0.304	0.260	0.198	0.166	0.141
379	4.00	29000	0.263	0.223	0.167	0.139	0.120
380	4.50	29000	0.242	0.204	0.152	0.127	0.110
381	5.00	29000	0.231	0.196	0.145	0.122	0.106
382	3.50	30000	0.305	0.262	0.201	0.168	0.142
383	4.00	30000	0.263	0.223	0.168	0.139	0.119
384	4.50	30000	0.241	0.204	0.152	0.127	0.109
385	5.00	30000	0.229	0.195	0.144	0.121	0.104
386	3.50	31000	0.305	0.264	0.204	0.170	0.144
387	4.00	31000	0.261	0.222	0.167	0.139	0.118
388	4.50	31000	0.239	0.203	0.151	0.126	0.108
389	5.00	31000	0.226	0.193	0.142	0.119	0.103
390	4.00	32000	0.259	0.220	0.166	0.138	0.117
391	4.50	32000	0.236	0.200	0.149	0.124	0.106
392	5.00	32000	0.223	0.190	0.140	0.117	0.100
393	4.00	33000	0.256	0.218	0.165	0.137	0.116
394	4.50	33000	0.232	0.197	0.146	0.121	0.103
395	5.00	33000	0.219	0.186	0.137	0.114	0.097
396	4.00	34000	0.251	0.214	0.164	0.137	0.116
397	4.50	34000	0.227	0.193	0.143	0.119	0.101
398	5.00	34000	0.214	0.181	0.133	0.111	0.094
399	4.00	35000	0.247	0.210	0.161	0.135	0.116
400	4.50	35000	0.222	0.188	0.141	0.117	0.100
401	5.00	35000	0.208	0.177	0.130	0.108	0.092
402	4.50	37500	0.206	0.173	0.132	0.111	0.096
403	5.00	37500	0.192	0.162	0.121	0.101	0.087
404	4.50	40000	0.198	0.165	0.126	0.107	0.094
405	5.00	40000	0.176	0.147	0.112	0.095	0.083
406	5.00	42500	0.169	0.141	0.108	0.093	0.082
407	5.00	45000	0.166	0.138	0.107	0.092	0.081
408	5.00	47500	0.164	0.136	0.106	0.092	0.081
409	5.00	50000	0.162	0.135	0.105	0.092	0.081

APPENDIX 5: Table of u_θ[U], u_θ[B], and u_θ[V]

Table Díaz-Cordovés

No	logg cm/s²	Teff K	u(U)	u(B)	u(V)
1	0.00	3500	0.749	0.869	0.901
2	0.50	3500	0.769	0.889	0.901
3	1.00	3500	0.793	0.904	0.897
4	1.50	3500	0.813	0.913	0.890
5	2.00	3500	0.828	0.918	0.882
6	2.50	3500	0.833	0.916	0.873
7	3.00	3500	0.827	0.899	0.853
8	3.50	3500	0.787	0.831	0.797
9	4.00	3500	0.739	0.757	0.733
10	4.50	3500	0.708	0.713	0.690
11	5.00	3500	0.692	0.692	0.663
12	0.00	3750	0.828	0.902	0.894
13	0.50	3750	0.836	0.916	0.896
14	1.00	3750	0.845	0.925	0.893
15	1.50	3750	0.853	0.928	0.886
16	2.00	3750	0.856	0.927	0.876
17	2.50	3750	0.850	0.920	0.864
18	3.00	3750	0.838	0.908	0.849
19	3.50	3750	0.811	0.877	0.819
20	4.00	3750	0.761	0.802	0.751
21	4.50	3750	0.712	0.725	0.680
22	5.00	3750	0.683	0.682	0.638
23	0.00	4000	0.932	0.921	0.874
24	0.50	4000	0.938	0.934	0.881
25	1.00	4000	0.943	0.943	0.883
26	1.50	4000	0.943	0.948	0.881
27	2.00	4000	0.935	0.947	0.876
28	2.50	4000	0.919	0.941	0.867
29	3.00	4000	0.895	0.931	0.856
30	3.50	4000	0.864	0.914	0.839
31	4.00	4000	0.821	0.877	0.805
32	4.50	4000	0.764	0.801	0.734
33	5.00	4000	0.715	0.726	0.661
34	0.00	4250	0.966	0.914	0.841
35	0.50	4250	0.974	0.928	0.851
36	1.00	4250	0.979	0.936	0.856
37	1.50	4250	0.981	0.941	0.858
38	2.00	4250	0.977	0.943	0.858
39	2.50	4250	0.966	0.941	0.855
40	3.00	4250	0.947	0.936	0.850
41	3.50	4250	0.919	0.926	0.841
42	4.00	4250	0.883	0.910	0.828
43	4.50	4250	0.836	0.877	0.798
44	5.00	4250	0.782	0.812	0.735
45	0.00	4500	0.946	0.893	0.806
46	0.50	4500	0.963	0.907	0.815
47	1.00	4500	0.973	0.916	0.821
48	1.50	4500	0.977	0.921	0.825
49	2.00	4500	0.975	0.923	0.828
50	2.50	4500	0.968	0.923	0.830
51	3.00	4500	0.956	0.919	0.829
52	3.50	4500	0.937	0.914	0.826
53	4.00	4500	0.911	0.905	0.819
54	4.50	4500	0.878	0.893	0.810
55	5.00	4500	0.840	0.869	0.789
56	0.00	4750	0.902	0.864	0.773
57	0.50	4750	0.929	0.882	0.784
58	1.00	4750	0.945	0.891	0.788
59	1.50	4750	0.956	0.897	0.792
60	2.00	4750	0.959	0.899	0.795
61	2.50	4750	0.956	0.899	0.797
62	3.00	4750	0.949	0.897	0.799
63	3.50	4750	0.936	0.893	0.800
64	4.00	4750	0.917	0.887	0.798
65	4.50	4750	0.893	0.879	0.795
66	5.00	4750	0.864	0.869	0.789
67	0.00	5000	0.860	0.839	0.742
68	0.50	5000	0.887	0.854	0.751
69	1.00	5000	0.908	0.866	0.757
70	1.50	5000	0.923	0.871	0.759
71	2.00	5000	0.931	0.873	0.761
72	2.50	5000	0.935	0.874	0.764
73	3.00	5000	0.933	0.872	0.766
74	3.50	5000	0.927	0.870	0.769
75	4.00	5000	0.914	0.865	0.771
76	4.50	5000	0.897	0.860	0.771
77	5.00	5000	0.875	0.852	0.770
78	0.00	5250	0.825	0.817	0.714
79	0.50	5250	0.848	0.831	0.721
80	1.00	5250	0.868	0.840	0.725
81	1.50	5250	0.884	0.846	0.729
82	2.00	5250	0.895	0.847	0.730
83	2.50	5250	0.903	0.848	0.733
84	3.00	5250	0.906	0.846	0.734
85	3.50	5250	0.907	0.845	0.737
86	4.00	5250	0.902	0.842	0.740
87	4.50	5250	0.892	0.839	0.742
88	5.00	5250	0.876	0.832	0.743
89	0.00	5500	0.817	0.848	0.744
90	0.50	5500	0.810	0.810	0.689
91	1.00	5500	0.827	0.818	0.693
92	1.50	5500	0.841	0.821	0.696
93	2.00	5500	0.853	0.821	0.698
94	2.50	5500	0.862	0.820	0.700
95	3.00	5500	0.870	0.819	0.703
96	3.50	5500	0.876	0.818	0.707
97	4.00	5500	0.877	0.817	0.710
98	4.50	5500	0.874	0.814	0.712
99	5.00	5500	0.866	0.809	0.714
100	0.00	5750	0.795	0.845	0.732
101	0.50	5750	0.810	0.855	0.736
102	1.00	5750	0.791	0.801	0.670
103	1.50	5750	0.799	0.801	0.669
104	2.00	5750	0.809	0.798	0.670
105	2.50	5750	0.821	0.797	0.673
106	3.00	5750	0.830	0.794	0.675
107	3.50	5750	0.838	0.793	0.679
108	4.00	5750	0.844	0.791	0.682
109	4.50	5750	0.847	0.789	0.684
110	5.00	5750	0.845	0.785	0.685
111	4.44	5777	0.842	0.785	0.681
112	0.00	6000	0.775	0.848	0.721
113	0.50	6000	0.784	0.850	0.725
114	1.00	6000	0.795	0.852	0.726
115	1.50	6000	0.763	0.784	0.651
116	2.00	6000	0.770	0.780	0.651
117	2.50	6000	0.777	0.775	0.650
118	3.00	6000	0.787	0.771	0.651
119	3.50	6000	0.797	0.768	0.653
120	4.00	6000	0.805	0.765	0.655
121	4.50	6000	0.811	0.762	0.657
122	5.00	6000	0.814	0.759	0.657
123	0.50	6250	0.762	0.851	0.715
124	1.00	6250	0.765	0.844	0.716
125	1.50	6250	0.772	0.839	0.714
126	2.00	6250	0.737	0.765	0.636
127	2.50	6250	0.738	0.757	0.633
128	3.00	6250	0.746	0.751	0.632
129	3.50	6250	0.755	0.745	0.633
130	4.00	6250	0.764	0.742	0.632
131	4.50	6250	0.773	0.738	0.633
132	5.00	6250	0.779	0.734	0.633
133	0.50	6500	0.739	0.848	0.707
134	1.00	6500	0.741	0.843	0.707

135	1.50	6500	0.742	0.828	0.704
136	2.00	6500	0.747	0.819	0.700
137	2.50	6500	0.709	0.743	0.622
138	3.00	6500	0.709	0.732	0.617
139	3.50	6500	0.716	0.726	0.616
140	4.00	6500	0.724	0.719	0.614
141	4.50	6500	0.733	0.714	0.613
142	5.00	6500	0.742	0.710	0.612
143	0.50	6750	0.715	0.827	0.692
144	1.00	6750	0.719	0.838	0.698
145	1.50	6750	0.718	0.826	0.695
146	2.00	6750	0.716	0.806	0.690
147	2.50	6750	0.720	0.795	0.684
148	3.00	6750	0.682	0.718	0.607
149	3.50	6750	0.682	0.706	0.602
150	4.00	6750	0.688	0.700	0.600
151	4.50	6750	0.696	0.694	0.598
152	5.00	6750	0.705	0.688	0.595
153	0.50	7000	0.691	0.797	0.675
154	1.00	7000	0.696	0.816	0.683
155	1.50	7000	0.696	0.819	0.686
156	2.00	7000	0.692	0.804	0.681
157	2.50	7000	0.691	0.780	0.673
158	3.00	7000	0.694	0.768	0.667
159	3.50	7000	0.657	0.694	0.594
160	4.00	7000	0.658	0.683	0.589
161	4.50	7000	0.664	0.675	0.585
162	5.00	7000	0.673	0.669	0.583
163	0.50	7250	0.669	0.756	0.654
164	1.00	7250	0.676	0.787	0.665
165	1.50	7250	0.676	0.798	0.670
166	2.00	7250	0.674	0.797	0.672
167	2.50	7250	0.669	0.775	0.664
168	3.00	7250	0.667	0.752	0.655
169	3.50	7250	0.670	0.739	0.649
170	4.00	7250	0.633	0.668	0.579
171	4.50	7250	0.636	0.658	0.574
172	5.00	7250	0.645	0.652	0.572
173	0.50	7500	0.640	0.697	0.625
174	1.00	7500	0.655	0.752	0.643
175	1.50	7500	0.655	0.769	0.649
176	2.00	7500	0.651	0.773	0.653
177	2.50	7500	0.647	0.769	0.654
178	3.00	7500	0.643	0.745	0.646
179	3.50	7500	0.644	0.723	0.637
180	4.00	7500	0.649	0.710	0.630
181	4.50	7500	0.614	0.643	0.566
182	5.00	7500	0.619	0.635	0.562
183	1.00	7750	0.638	0.713	0.622
184	1.50	7750	0.638	0.737	0.628
185	2.00	7750	0.633	0.744	0.632
186	2.50	7750	0.628	0.744	0.635
187	3.00	7750	0.621	0.737	0.634
188	3.50	7750	0.619	0.713	0.627
189	4.00	7750	0.622	0.692	0.619
190	4.50	7750	0.629	0.679	0.611
191	5.00	7750	0.599	0.620	0.553
192	1.00	8000	0.618	0.675	0.600
193	1.50	8000	0.621	0.706	0.608
194	2.00	8000	0.616	0.716	0.610
195	2.50	8000	0.609	0.718	0.612
196	3.00	8000	0.602	0.715	0.615
197	3.50	8000	0.597	0.704	0.614
198	4.00	8000	0.597	0.679	0.607
199	4.50	8000	0.604	0.662	0.600
200	5.00	8000	0.583	0.609	0.547
201	1.00	8250	0.609	0.644	0.581
202	1.50	8250	0.606	0.677	0.590
203	2.00	8250	0.600	0.689	0.591
204	2.50	8250	0.591	0.692	0.591
205	3.00	8250	0.582	0.690	0.594
206	3.50	8250	0.576	0.685	0.596
207	4.00	8250	0.575	0.671	0.594
208	4.50	8250	0.580	0.648	0.588
209	5.00	8250	0.589	0.633	0.580
210	1.50	8500	0.596	0.654	0.576

211	2.00	8500	0.587	0.666	0.575
212	2.50	8500	0.577	0.669	0.574
213	3.00	8500	0.566	0.667	0.573
214	3.50	8500	0.557	0.662	0.575
215	4.00	8500	0.553	0.655	0.577
216	4.50	8500	0.555	0.637	0.575
217	5.00	8500	0.565	0.616	0.568
218	1.50	8750	0.592	0.636	0.564
219	2.00	8750	0.581	0.647	0.562
220	2.50	8750	0.569	0.650	0.559
221	3.00	8750	0.555	0.647	0.557
222	3.50	8750	0.543	0.642	0.557
223	4.00	8750	0.535	0.635	0.559
224	4.50	8750	0.532	0.624	0.560
225	5.00	8750	0.541	0.604	0.556
226	1.50	9000	0.59	0.622	0.555
227	2.00	9000	0.575	0.631	0.551
228	2.50	9000	0.562	0.633	0.548
229	3.00	9000	0.547	0.630	0.544
230	3.50	9000	0.532	0.624	0.542
231	4.00	9000	0.521	0.616	0.543
232	4.50	9000	0.515	0.607	0.544
233	5.00	9000	0.516	0.598	0.548
234	2.00	9250	0.571	0.618	0.542
235	2.50	9250	0.557	0.619	0.537
236	3.00	9250	0.542	0.616	0.533
237	3.50	9250	0.526	0.610	0.530
238	4.00	9250	0.512	0.601	0.529
239	4.50	9250	0.503	0.591	0.530
240	5.00	9250	0.500	0.581	0.532
241	2.00	9500	0.567	0.606	0.533
242	2.50	9500	0.553	0.606	0.527
243	3.00	9500	0.538	0.604	0.523
244	3.50	9500	0.523	0.598	0.520
245	4.00	9500	0.508	0.589	0.518
246	4.50	9500	0.495	0.578	0.517
247	5.00	9500	0.488	0.566	0.518
248	2.00	9750	0.563	0.595	0.525
249	2.50	9750	0.548	0.594	0.518
250	3.00	9750	0.534	0.592	0.514
251	3.50	9750	0.519	0.587	0.510
252	4.00	9750	0.504	0.578	0.508
253	4.50	9750	0.491	0.567	0.507
254	5.00	9750	0.481	0.554	0.507
255	2.00	10000	0.557	0.586	0.517
256	2.50	10000	0.543	0.584	0.510
257	3.00	10000	0.529	0.580	0.505
258	3.50	10000	0.515	0.575	0.501
259	4.00	10000	0.500	0.568	0.499
260	4.50	10000	0.487	0.557	0.497
261	5.00	10000	0.476	0.545	0.497
262	2.00	10500	0.545	0.570	0.504
263	2.50	10500	0.532	0.565	0.493
264	3.00	10500	0.519	0.56	0.488
265	3.50	10500	0.507	0.555	0.484
266	4.00	10500	0.494	0.549	0.482
267	4.50	10500	0.481	0.540	0.480
268	5.00	10500	0.470	0.528	0.478
269	2.50	11000	0.519	0.548	0.479
270	3.00	11000	0.507	0.542	0.472
271	3.50	11000	0.496	0.537	0.468
272	4.00	11000	0.485	0.531	0.466
273	4.50	11000	0.475	0.523	0.465
274	5.00	11000	0.464	0.513	0.463
275	2.50	11500	0.506	0.535	0.467
276	3.00	11500	0.493	0.525	0.457
277	3.50	11500	0.483	0.519	0.453
278	4.00	11500	0.474	0.514	0.451
279	4.50	11500	0.466	0.507	0.450
280	5.00	11500	0.457	0.498	0.450
281	2.50	12000	0.496	0.524	0.457
282	3.00	12000	0.481	0.512	0.444
283	3.50	12000	0.470	0.503	0.439
284	4.00	12000	0.463	0.497	0.437
285	4.50	12000	0.455	0.492	0.436
286	5.00	12000	0.449	0.484	0.436

287	2.50	12500	0.488	0.515	0.450
288	3.00	12500	0.469	0.500	0.434
289	3.50	12500	0.459	0.490	0.426
290	4.00	12500	0.450	0.483	0.424
291	4.50	12500	0.444	0.477	0.423
292	5.00	12500	0.440	0.471	0.424
293	2.50	13000	0.482	0.509	0.444
294	3.00	13000	0.461	0.491	0.426
295	3.50	13000	0.448	0.479	0.416
296	4.00	13000	0.439	0.471	0.412
297	4.50	13000	0.433	0.464	0.411
298	5.00	13000	0.429	0.458	0.412
299	2.00	14000	0.515	0.532	0.479
300	2.50	14000	0.475	0.500	0.437
301	3.00	14000	0.449	0.476	0.413
302	3.50	14000	0.431	0.460	0.399
303	4.00	14000	0.420	0.449	0.393
304	4.50	14000	0.413	0.441	0.390
305	5.00	14000	0.410	0.435	0.391
306	2.50	15000	0.473	0.494	0.434
307	3.00	15000	0.441	0.466	0.404
308	3.50	15000	0.420	0.446	0.387
309	4.00	15000	0.406	0.433	0.378
310	4.50	15000	0.398	0.423	0.374
311	5.00	15000	0.393	0.415	0.373
312	2.50	16000	0.473	0.491	0.434
313	3.00	16000	0.437	0.459	0.399
314	3.50	16000	0.413	0.436	0.378
315	4.00	16000	0.397	0.421	0.366
316	4.50	16000	0.386	0.409	0.360
317	5.00	16000	0.380	0.400	0.358
318	2.50	17000	0.476	0.489	0.436
319	3.00	17000	0.435	0.454	0.395
320	3.50	17000	0.407	0.428	0.371
321	4.00	17000	0.389	0.411	0.358
322	4.50	17000	0.377	0.398	0.35
323	5.00	17000	0.370	0.387	0.346
324	2.50	18000	0.480	0.489	0.440
325	3.00	18000	0.434	0.449	0.394
326	3.50	18000	0.404	0.422	0.366
327	4.00	18000	0.384	0.402	0.351
328	4.50	18000	0.371	0.388	0.342
329	5.00	18000	0.362	0.377	0.337
330	2.50	19000	0.483	0.489	0.443
331	3.00	19000	0.434	0.445	0.392
332	3.50	19000	0.401	0.415	0.363
333	4.00	19000	0.379	0.395	0.344
334	4.50	19000	0.365	0.380	0.334
335	5.00	19000	0.356	0.368	0.329
336	3.00	20000	0.434	0.441	0.392
337	3.50	20000	0.400	0.410	0.359
338	4.00	20000	0.376	0.388	0.340
339	4.50	20000	0.361	0.373	0.328
340	5.00	20000	0.351	0.361	0.322
341	3.00	21000	0.432	0.437	0.390
342	3.50	21000	0.397	0.404	0.356
343	4.00	21000	0.373	0.382	0.335
344	4.50	21000	0.357	0.366	0.323
345	5.00	21000	0.347	0.354	0.316
346	3.00	22000	0.430	0.435	0.389
347	3.50	22000	0.394	0.398	0.352
348	4.00	22000	0.370	0.375	0.331
349	4.50	22000	0.354	0.360	0.318
350	5.00	22000	0.344	0.348	0.311
351	3.00	23000	0.431	0.436	0.392
352	3.50	23000	0.390	0.393	0.348
353	4.00	23000	0.366	0.368	0.326
354	4.50	23000	0.351	0.353	0.313
355	5.00	23000	0.341	0.342	0.305
356	3.00	24000	0.436	0.441	0.398
357	3.50	24000	0.386	0.389	0.345
358	4.00	24000	0.361	0.363	0.321
359	4.50	24000	0.347	0.347	0.308
360	5.00	24000	0.337	0.335	0.301
361	3.00	25000	0.444	0.446	0.407
362	3.50	25000	0.386	0.388	0.345
363	4.00	25000	0.357	0.357	0.316
364	4.50	25000	0.342	0.340	0.303
365	5.00	25000	0.334	0.329	0.296
366	3.00	26000	0.449	0.450	0.414
367	3.50	26000	0.388	0.390	0.347
368	4.00	26000	0.354	0.354	0.314
369	4.50	26000	0.337	0.334	0.298
370	5.00	26000	0.329	0.322	0.291
371	3.50	27000	0.392	0.392	0.351
372	4.00	27000	0.353	0.352	0.313
373	4.50	27000	0.334	0.329	0.294
374	5.00	27000	0.325	0.316	0.286
375	3.50	28000	0.392	0.392	0.353
376	4.00	28000	0.353	0.352	0.313
377	4.50	28000	0.331	0.326	0.292
378	5.00	28000	0.320	0.311	0.281
379	3.50	29000	0.392	0.391	0.354
380	4.00	29000	0.353	0.351	0.313
381	4.50	29000	0.329	0.324	0.289
382	5.00	29000	0.317	0.307	0.277
383	3.50	30000	0.390	0.388	0.352
384	4.00	30000	0.352	0.349	0.311
385	4.50	30000	0.328	0.322	0.288
386	5.00	30000	0.314	0.305	0.274
387	3.50	31000	0.387	0.386	0.351
388	4.00	31000	0.348	0.344	0.308
389	4.50	31000	0.325	0.318	0.284
390	5.00	31000	0.310	0.301	0.271
391	4.00	32000	0.342	0.337	0.303
392	4.50	32000	0.319	0.312	0.280
393	5.00	32000	0.305	0.295	0.266
394	4.00	33000	0.336	0.331	0.298
395	4.50	33000	0.312	0.305	0.274
396	5.00	33000	0.299	0.288	0.261
397	4.00	34000	0.329	0.325	0.292
398	4.50	34000	0.305	0.297	0.267
399	5.00	34000	0.292	0.281	0.254
400	4.00	35000	0.323	0.320	0.287
401	4.50	35000	0.297	0.289	0.260
402	5.00	35000	0.284	0.273	0.247
403	4.00	37500	0.277	0.270	0.242
404	4.50	37500	0.260	0.250	0.226
405	5.00	40000	0.269	0.263	0.233
406	5.00	40000	0.242	0.233	0.209
407	5.00	42500	0.234	0.226	0.201
408	5.00	45000	0.231	0.223	0.197
409	5.00	47500	0.228	0.220	0.194
410	5.00	50000	0.226	0.217	0.192

APPENDIX 6: Table of u_θ[L] and u_θ[N]

Table van Hamme

No	log(g) cm/s²	Teff K	u(L)	u(N)
1	0.0	3500	0.242	0.117
2	0.5	3500	0.240	0.113
3	1.0	3500	0.238	0.111
4	1.5	3500	0.235	0.108
5	2.0	3500	0.233	0.106
6	2.5	3500	0.231	0.105
7	3.0	3500	0.222	0.104
8	3.5	3500	0.184	0.094
9	4.0	3500	0.137	0.083
10	4.5	3500	0.116	0.077
11	5.0	3500	0.106	0.074
12	0.0	3750	0.237	0.120
13	0.5	3750	0.236	0.118
14	1.0	3750	0.235	0.115
15	1.5	3750	0.233	0.112
16	2.0	3750	0.232	0.111
17	2.5	3750	0.231	0.109
18	3.0	3750	0.229	0.107
19	3.5	3750	0.219	0.104
20	4.0	3750	0.184	0.095
21	4.5	3750	0.143	0.086
22	5.0	3750	0.120	0.079
23	0.0	4000	0.228	0.117
24	0.5	4000	0.227	0.116
25	1.0	4000	0.226	0.114
26	1.5	4000	0.226	0.111
27	2.0	4000	0.226	0.110
28	2.5	4000	0.226	0.109
29	3.0	4000	0.226	0.108
30	3.5	4000	0.224	0.107
31	4.0	4000	0.214	0.104
32	4.5	4000	0.183	0.096
33	5.0	4000	0.147	0.088
34	0.0	4250	0.216	0.111
35	0.5	4250	0.216	0.110
36	1.0	4250	0.215	0.110
37	1.5	4250	0.215	0.107
38	2.0	4250	0.216	0.106
39	2.5	4250	0.217	0.105
40	3.0	4250	0.218	0.104
41	3.5	4250	0.218	0.105
42	4.0	4250	0.217	0.104
43	4.5	4250	0.209	0.102
44	5.0	4250	0.182	0.097
45	0.0	4500	0.203	0.105
46	0.5	4500	0.202	0.103
47	1.0	4500	0.203	0.103
48	1.5	4500	0.203	0.102
49	2.0	4500	0.205	0.101
50	2.5	4500	0.207	0.100
51	3.0	4500	0.208	0.100
52	3.5	4500	0.209	0.099
53	4.0	4500	0.210	0.098
54	4.5	4500	0.210	0.099
55	5.0	4500	0.202	0.098
56	0.0	4750	0.189	0.101
57	0.5	4750	0.192	0.098
58	1.0	4750	0.191	0.095
59	1.5	4750	0.193	0.095
60	2.0	4750	0.195	0.095
61	2.5	4750	0.196	0.095
62	3.0	4750	0.198	0.095
63	3.5	4750	0.200	0.094
64	4.0	4750	0.201	0.094
65	4.5	4750	0.201	0.093
66	5.0	4750	0.201	0.094
67	0.0	5000	0.174	0.097
68	0.5	5000	0.176	0.093
69	1.0	5000	0.179	0.091
70	1.5	5000	0.181	0.090
71	2.0	5000	0.182	0.091
72	2.5	5000	0.186	0.090
73	3.0	5000	0.188	0.090
74	3.5	5000	0.189	0.089
75	4.0	5000	0.191	0.090
76	4.5	5000	0.192	0.089
77	5.0	5000	0.193	0.089
78	0.0	5250	0.161	0.092
79	0.5	5250	0.163	0.090
80	1.0	5250	0.166	0.088
81	1.5	5250	0.168	0.087
82	2.0	5250	0.171	0.087
83	2.5	5250	0.175	0.085
84	3.0	5250	0.177	0.086
85	3.5	5250	0.180	0.084
86	4.0	5250	0.182	0.085
87	4.5	5250	0.183	0.085
88	5.0	5250	0.185	0.085
89	0.0	5500	0.165	0.082
90	0.5	5500	0.149	0.088
91	1.0	5500	0.151	0.085
92	1.5	5500	0.153	0.085
93	2.0	5500	0.158	0.085
94	2.5	5500	0.162	0.082
95	3.0	5500	0.167	0.082
96	3.5	5500	0.170	0.081
97	4.0	5500	0.173	0.081
98	4.5	5500	0.175	0.081
99	5.0	5500	0.176	0.081
100	0.0	5750	0.159	0.079
101	0.5	5750	0.157	0.077
102	1.0	5750	0.140	0.082
103	1.5	5750	0.144	0.081
104	2.0	5750	0.148	0.080
105	2.5	5750	0.152	0.080
106	3.0	5750	0.157	0.079
107	3.5	5750	0.161	0.078
108	4.0	5750	0.165	0.077
109	4.5	5750	0.166	0.077
110	5.0	5750	0.168	0.078
111	0.0	6000	0.154	0.077
112	0.5	6000	0.150	0.074
113	1.0	6000	0.150	0.072
114	1.5	6000	0.134	0.080
115	2.0	6000	0.137	0.078
116	2.5	6000	0.142	0.077
117	3.0	6000	0.147	0.076
118	3.5	6000	0.152	0.075
119	4.0	6000	0.156	0.075
120	4.5	6000	0.158	0.075
121	5.0	6000	0.160	0.075
122	0.5	6250	0.144	0.071
123	1.0	6250	0.143	0.070
124	1.5	6250	0.144	0.069
125	2.0	6250	0.132	0.076
126	2.5	6250	0.134	0.075
127	3.0	6250	0.139	0.074
128	3.5	6250	0.143	0.073
129	4.0	6250	0.147	0.072
130	4.5	6250	0.151	0.071

131	5.0	6250	0.153	0.071
132	0.5	6500	0.141	0.070
133	1.0	6500	0.137	0.067
134	1.5	6500	0.137	0.066
135	2.0	6500	0.139	0.066
136	2.5	6500	0.131	0.071
137	3.0	6500	0.133	0.071
138	3.5	6500	0.137	0.070
139	4.0	6500	0.141	0.069
140	4.5	6500	0.144	0.068
141	5.0	6500	0.146	0.068
142	0.5	6750	0.140	0.069
143	1.0	6750	0.132	0.065
144	1.5	6750	0.130	0.064
145	2.0	6750	0.132	0.063
146	2.5	6750	0.134	0.063
147	3.0	6750	0.129	0.067
148	3.5	6750	0.131	0.068
149	4.0	6750	0.134	0.067
150	4.5	6750	0.138	0.066
151	5.0	6750	0.140	0.066
152	0.5	7000	0.140	0.069
153	1.0	7000	0.130	0.064
154	1.5	7000	0.126	0.062
155	2.0	7000	0.126	0.061
156	2.5	7000	0.127	0.061
157	3.0	7000	0.129	0.061
158	3.5	7000	0.128	0.064
159	4.0	7000	0.130	0.065
160	4.5	7000	0.132	0.065
161	5.0	7000	0.135	0.064
162	0.5	7250	0.142	0.072
163	1.0	7250	0.129	0.063
164	1.5	7250	0.123	0.061
165	2.0	7250	0.121	0.059
166	2.5	7250	0.122	0.059
167	3.0	7250	0.123	0.059
168	3.5	7250	0.125	0.061
169	4.0	7250	0.126	0.063
170	4.5	7250	0.127	0.063
171	5.0	7250	0.130	0.063
172	0.5	7500	0.146	0.073
173	1.0	7500	0.128	0.065
174	1.5	7500	0.121	0.062
175	2.0	7500	0.118	0.058
176	2.5	7500	0.117	0.057
177	3.0	7500	0.118	0.057
178	3.5	7500	0.119	0.059
179	4.0	7500	0.121	0.058
180	4.5	7500	0.124	0.061
181	5.0	7500	0.126	0.061
182	1.0	7750	0.128	0.064
183	1.5	7750	0.119	0.060
184	2.0	7750	0.114	0.059
185	2.5	7750	0.113	0.058
186	3.0	7750	0.113	0.057
187	3.5	7750	0.114	0.057
188	4.0	7750	0.116	0.056
189	4.5	7750	0.121	0.059
190	5.0	7750	0.123	0.059
191	1.0	8000	0.130	0.066
192	1.5	8000	0.117	0.059
193	2.0	8000	0.111	0.057
194	2.5	8000	0.109	0.056
195	3.0	8000	0.109	0.055
196	3.5	8000	0.109	0.055
197	4.0	8000	0.111	0.055
198	4.5	8000	0.113	0.055
199	5.0	8000	0.120	0.056
200	1.0	8250	0.134	0.065
201	1.5	8250	0.116	0.059
202	2.0	8250	0.109	0.055
203	2.5	8250	0.105	0.054
204	3.0	8250	0.104	0.053
205	3.5	8250	0.105	0.053
206	4.0	8250	0.106	0.054
207	4.5	8250	0.108	0.054
208	5.0	8250	0.110	0.054
209	1.0	8500	0.144	0.067
210	1.5	8500	0.116	0.057
211	2.0	8500	0.107	0.054
212	2.5	8500	0.102	0.053
213	3.0	8500	0.100	0.051
214	3.5	8500	0.100	0.051
215	4.0	8500	0.101	0.052
216	4.5	8500	0.102	0.052
217	5.0	8500	0.105	0.052
218	1.5	8750	0.118	0.057
219	2.0	8750	0.106	0.052
220	2.5	8750	0.100	0.051
221	3.0	8750	0.097	0.050
222	3.5	8750	0.096	0.050
223	4.0	8750	0.096	0.049
224	4.5	8750	0.097	0.050
225	5.0	8750	0.100	0.050
226	1.5	9000	0.121	0.057
227	2.0	9000	0.106	0.051
228	2.5	9000	0.099	0.049
229	3.0	9000	0.095	0.048
230	3.5	9000	0.093	0.048
231	4.0	9000	0.093	0.048
232	4.5	9000	0.093	0.049
233	5.0	9000	0.094	0.050
234	2.0	9250	0.106	0.051
235	2.5	9250	0.098	0.048
236	3.0	9250	0.094	0.046
237	3.5	9250	0.091	0.046
238	4.0	9250	0.090	0.047
239	4.5	9250	0.090	0.047
240	5.0	9250	0.090	0.048
241	2.0	9500	0.106	0.051
242	2.5	9500	0.097	0.047
243	3.0	9500	0.092	0.045
244	3.5	9500	0.090	0.044
245	4.0	9500	0.088	0.045
246	4.5	9500	0.087	0.045
247	5.0	9500	0.087	0.046
248	2.0	9750	0.107	0.051
249	2.5	9750	0.097	0.047
250	3.0	9750	0.091	0.045
251	3.5	9750	0.088	0.044
252	4.0	9750	0.087	0.043
253	4.5	9750	0.086	0.044
254	5.0	9750	0.085	0.045
255	2.0	10000	0.107	0.052
256	2.5	10000	0.096	0.047
257	3.0	10000	0.090	0.044
258	3.5	10000	0.087	0.043
259	4.0	10000	0.085	0.043
260	4.5	10000	0.084	0.043
261	5.0	10000	0.084	0.044
262	2.0	10500	0.105	0.052
263	2.5	10500	0.095	0.046
264	3.0	10500	0.089	0.043
265	3.5	10500	0.085	0.042
266	4.0	10500	0.083	0.041
267	4.5	10500	0.082	0.041
268	5.0	10500	0.081	0.042
269	2.5	11000	0.092	0.047
270	3.0	11000	0.086	0.043
271	3.5	11000	0.083	0.041
272	4.0	11000	0.081	0.040
273	4.5	11000	0.080	0.040
274	5.0	11000	0.079	0.040
275	2.5	11500	0.090	0.046
276	3.0	11500	0.084	0.043
277	3.5	11500	0.080	0.041
278	4.0	11500	0.079	0.039
279	4.5	11500	0.078	0.039
280	5.0	11500	0.077	0.040
281	2.5	12000	0.087	0.047
282	3.0	12000	0.081	0.043

283	3.5	12000	0.078	0.041
284	4.0	12000	0.076	0.039
285	4.5	12000	0.075	0.038
286	5.0	12000	0.075	0.038
287	2.5	12500	0.085	0.046
288	3.0	12500	0.078	0.043
289	3.5	12500	0.075	0.040
290	4.0	12500	0.074	0.039
291	4.5	12500	0.073	0.038
292	5.0	12500	0.072	0.038
293	2.5	13000	0.084	0.046
294	3.0	13000	0.076	0.042
295	3.5	13000	0.073	0.040
296	4.0	13000	0.071	0.039
297	4.5	13000	0.070	0.038
298	5.0	13000	0.070	0.037
299	2.0	14000	0.103	0.054
300	2.5	14000	0.083	0.046
301	3.0	14000	0.074	0.042
302	3.5	14000	0.070	0.040
303	4.0	14000	0.068	0.038
304	4.5	14000	0.067	0.037
305	5.0	14000	0.067	0.037
306	2.5	15000	0.083	0.047
307	3.0	15000	0.072	0.042
308	3.5	15000	0.067	0.040
309	4.0	15000	0.065	0.038
310	4.5	15000	0.064	0.037
311	5.0	15000	0.064	0.037
312	2.5	16000	0.084	0.047
313	3.0	16000	0.072	0.042
314	3.5	16000	0.066	0.039
315	4.0	16000	0.063	0.038
316	4.5	16000	0.062	0.038
317	5.0	16000	0.061	0.037
318	2.5	17000	0.086	0.049
319	3.0	17000	0.072	0.042
320	3.5	17000	0.065	0.039
321	4.0	17000	0.061	0.038
322	4.5	17000	0.060	0.037
323	5.0	17000	0.060	0.037
324	2.5	18000	0.090	0.051
325	3.0	18000	0.072	0.044
326	3.5	18000	0.064	0.040
327	4.0	18000	0.060	0.038
328	4.5	18000	0.059	0.037
329	5.0	18000	0.058	0.037
330	2.5	19000	0.096	0.055
331	3.0	19000	0.074	0.045
332	3.5	19000	0.065	0.041
333	4.0	19000	0.060	0.038
334	4.5	19000	0.058	0.037
335	5.0	19000	0.057	0.037
336	3.0	20000	0.077	0.047
337	3.5	20000	0.066	0.042
338	4.0	20000	0.060	0.039
339	4.5	20000	0.058	0.038
340	5.0	20000	0.057	0.037
341	3.0	21000	0.080	0.050
342	3.5	21000	0.067	0.044
343	4.0	21000	0.061	0.041
344	4.5	21000	0.058	0.039
345	5.0	21000	0.057	0.038
346	3.0	22000	0.084	0.052
347	3.5	22000	0.070	0.046
348	4.0	22000	0.063	0.042
349	4.5	22000	0.059	0.041
350	5.0	22000	0.058	0.040
351	3.0	23000	0.086	0.053
352	3.5	23000	0.072	0.047
353	4.0	23000	0.065	0.043
354	4.5	23000	0.061	0.041
355	5.0	23000	0.059	0.040
356	3.0	24000	0.088	0.053
357	3.5	24000	0.074	0.047
358	4.0	24000	0.067	0.044
359	4.5	24000	0.063	0.042
360	5.0	24000	0.061	0.041
361	3.0	25000	0.091	0.053
362	3.5	25000	0.075	0.047
363	4.0	25000	0.068	0.044
364	4.5	25000	0.064	0.042
365	5.0	25000	0.062	0.041
366	3.0	26000	0.094	0.054
367	3.5	26000	0.075	0.047
368	4.0	26000	0.069	0.044
369	4.5	26000	0.065	0.042
370	5.0	26000	0.064	0.041
371	3.5	27000	0.076	0.046
372	4.0	27000	0.069	0.043
373	4.5	27000	0.066	0.041
374	5.0	27000	0.064	0.040
375	3.5	28000	0.077	0.046
376	4.0	28000	0.069	0.043
377	4.5	28000	0.065	0.041
378	5.0	28000	0.064	0.039
379	3.5	29000	0.077	0.046
380	4.0	29000	0.069	0.042
381	4.5	29000	0.065	0.041
382	5.0	29000	0.063	0.039
383	3.5	30000	0.077	0.046
384	4.0	30000	0.068	0.042
385	4.5	30000	0.064	0.040
386	5.0	30000	0.062	0.039
387	3.5	31000	0.077	0.047
388	4.0	31000	0.067	0.041
389	4.5	31000	0.063	0.039
390	5.0	31000	0.061	0.038
391	4.0	32000	0.066	0.042
392	4.5	32000	0.061	0.039
393	5.0	32000	0.059	0.037
394	4.0	33000	0.065	0.043
395	4.5	33000	0.060	0.039
396	5.0	33000	0.057	0.037
397	4.0	34000	0.065	0.044
398	4.5	34000	0.059	0.039
399	5.0	34000	0.056	0.037
400	4.0	35000	0.065	0.044
401	4.5	35000	0.058	0.040
402	5.0	35000	0.054	0.037
403	4.5	37500	0.056	0.042
404	5.0	37500	0.052	0.040
405	4.5	40000	0.054	0.042
406	5.0	40000	0.050	0.040
407	5.0	42500	0.049	0.041
408	5.0	45000	0.049	0.040
409	5.0	47500	0.049	0.041
410	5.0	50000	0.049	0.041