Report of Synthesized Word

This report will be divided into two parts. In the first part, I will describe the basic strategy I used during synthesis, while the second part will be focused on the discussion of the perceived results which will be the feedback of classmate’s perception and improvements of acoustic details.

## 1 Synthesis strategy

In order to do this work, I divided it into three parts. First, segmentation. Second, dot-to-dot excel form making. Last, inputting and modification.

### Segmentation

At first, I selected one of the three repetitive recordings, based on the whole rendition and spectrogram clarity (clearer formant transitions, less unnecessary energy strokes). Then annotate the extract sound file using Praat.

### Form making

In order to synthesize a word that is similar to my voice, some conscientious calibration has to be done. the time point should be varied depending on different parameters or sets of parameters. dot-to-dot gram is good enough for words with less duration. word like mine which has three syllables and 900ms long, might using a excel form to fill the parametric values into appropriate time slots. the input of the values using dot-to-dot gram can be difficult, while values in form can be straightforward and easier for inputting.

In my case, I have all the formants (F1 to F6) values vary along the same time line. the rest parameters vary according to their individual timeline, because some parameters need to be turned on and off at specific short time period. it would be easier to set a new time line for them instead of inserting the time slots into the formants' timeline. The rest of the parameter that I have calibrated are A2F to A6F, AF, F0, AV, AH, AB. In total, there are 16 parameters having been calibrated.

#### F1, F2, F3, F4, F5 and F6.

1), Roughly, from 0-140ms are the values for [s], all six formants have been calibrated base on the original spectrogram. Three temporal loci (0ms, 90ms, 140ms) have been chosen to represent the overall contour of the formants of [s]. Since [s] has a high-frequency noise region which can be used as a cue to be differentiated from [ʃ], the F5 and F6 value has been altered only for this time period. In the rest period, F5 and F6 have been turned off.

2), From 145ms to 205ms are the values for the closure phase of [p]. According to Kent (1992), [p] has a low frequency dominance which roughly corresponds with F1 region. Thus, during this closure, F1 has been given a low value (500 Hz start, 290 Hz end) with the rest being turned off.

3), From 205ms to 210ms is the release of unaspirated [p]. A low value of 200Hz is assigned to F1 at 210ms, where the CV transition begins.

4), From 210ms to 510ms are the values for the segment /pəɹæ/. Because there has no obvious amplitude reduce occurring in this time period, I decided to single out certain time points to represent the transition point without change the values frequently. First, discern the transition pattern for /pə/. According to previous formant transition studies (Kent, 1992; Johnson, 1996), I noticed that the transition pattern of /bɛ/ can be used as the reference in this case, where the unaspirated [p] has the similar acoustic properties with [b], and schwa [ə] has similar height with front [ɛ]. In this pattern, both F1 and F2 have risen abruptly within a short time period (roughly 10ms). The initial value of F1 and F2 for /p/ at 210ms are 245Hz and 1055Hz respectively. Then, an abrupt rise in both F1 and F2 within 10ms, where F1 becomes 407Hz and F2 1244Hz. Second, the approximant /ɹ/ has lowered the f3 value of preceding schwa prominently. In addition, the rise of F3 for the next vowel is gradually. in order to represent the characteristics, I have singled out several time points (305ms, 320ms, and 340ms) with gradual increasement of F3 values (1714Hz, 1759Hz, and 1949Hz respectively). In contrast, F1 and F2 values have not been affected too much. Last, at 510ms, the vowel /æ/ has been affected by the following tap /ɾ/, where the F1 drops from 659Hz to 521Hz and F2 rises from 1650Hz to 1705Hz.

5), From 515ms to 535ms are the values for the closure of /ɾ/. According to Kent (1992), /t/ has a high frequency concentration, which roughly corresponds with F3 and F4 regions. Both /t/ and /ɾ/ have similar acoustic properties, thus I assume that the tap also has a high frequency concentration. in light of this assumption, I kept the F3 and F4 consistent with previous segments and turned off the F1 and F2 values for the closure period.

6), From 545ms to 750ms are the values for the segment /ɾɪ/. the transition pattern of /ɾɪ/ is similar with /di/, where both F1 and F2 will have an abrupt increase within a short amount of time (10ms). In this case, the initial (545ms) values of F1 and F2 are 230Hz and 1642Hz respectively. Within 10ms (555ms), they rise to 407Hz and 1745Hz, respectively. Similarly, the ending values of F1, F2 and F3 for /ɪ/ has been affected by the following velar plosive /k/. From the spectrogram, the wedge shape of F2 (1958Hz, 750ms) and F3 (2324Hz, 750ms) ("velar pinch") can be easily identified, whereas the F1 decreases from 500Hz (665ms) to 230Hz (750ms) accordingly.

7), From 755ms to 820ms are the values for the closure of /k/. According to Halle, Hughes, and Radley (1957), the burst spectra for the velar /k/ had strong concentrations of energy in the intermediate frequency regions which roughly corresponds to F2 and F3 regions. Thus, the F1 and F4 values had been turned off, whereas the F2(1958Hz) and F3(2324Hz) values kept consistent with previous parameters.

8), From the 825ms to 900ms are the values for the burst of /kʰ/. During this period, all the formants values have been turned on, with F1 starting at 300Hz (825ms) and lasting to the end, F2 starting at 1958Hz (825ms) and ending at 1900Hz, F3 from 2500Hz (825ms) to 2200 Hz (900ms), F4 keeping 3600Hz (825ms) consistently to the end.

#### A2F to A6F

According to Klatt (1990), A2F to A6F parameters are the amplitude of the parallel formants and determine the spectral shape of fricatives or plosive burst. in other words, by turning on these parameters, certain formants can be boosted by corresponding AXF (X represents 2 to 6) and match the original energy concentration region. the AXF parameters have been turned on for different fricatives and plosives according to their specific frequency dominance regions. For example, [s] has a very high-frequency energy concentration up to 8kHz.

In my case, A5F and A6F have been turned on at 0ms where the fricative [s] begins and last to the end(145ms) of the frication. They have been set to 50dB and 60dB initially and reduced to 25dB and 30dB at 145ms.

A2F and A3F have been set to 50dB at 200ms for the unaspirated [p] lasting 15ms and turned off at 220ms. at 820ms, they have been turned on again for the burst of [k].

A4F have been turned on only at 820ms for the burst of [k] lasting 60ms, then being turned off at 885ms.

#### AF

According to Klatt (1990), this variable should be turned on gradually for fricative (0 to 60 dB in about 90ms), and abruptly to about 60dB for plosive bursts. in light of the instruction, i turned on AF gradually for [s], updating the value every 5ms. then this variable had been turned on for the release of [k] abruptly setting to 63dB initially and lasting 5ms.

#### F0

F0 is the parameter to determine the pitch of the word. i selected several representative time points where the contour of pitch movement can be captured so that the voice might sound like my own voice.

#### AV, AH and AB

AV is the amplitude of voice; thus, it has been turned off during the initial fricative (0ms to 140ms) and closure of [p] (140ms to 205ms) and [k] (755ms to 795ms) time period.

AH is a variable for the aspiration. in my case, it has been only turned on at the final burst period and set to 45dB at 815ms. it then reached to 60dB at 825ms and reduced to 20dB at 840ms.

AB has been turned on for both the release of [p] and [k] and set to 60dB and 63 dB respectively.

### Input and Modification

There is only one word for input: patience.

Modification: the first few times was not very successful. What I have done to improve the intelligibility was to compare the spectrogram and waveform of synthesized version to those of the original one. According to the listening and comparison, then certain parameters were modified.

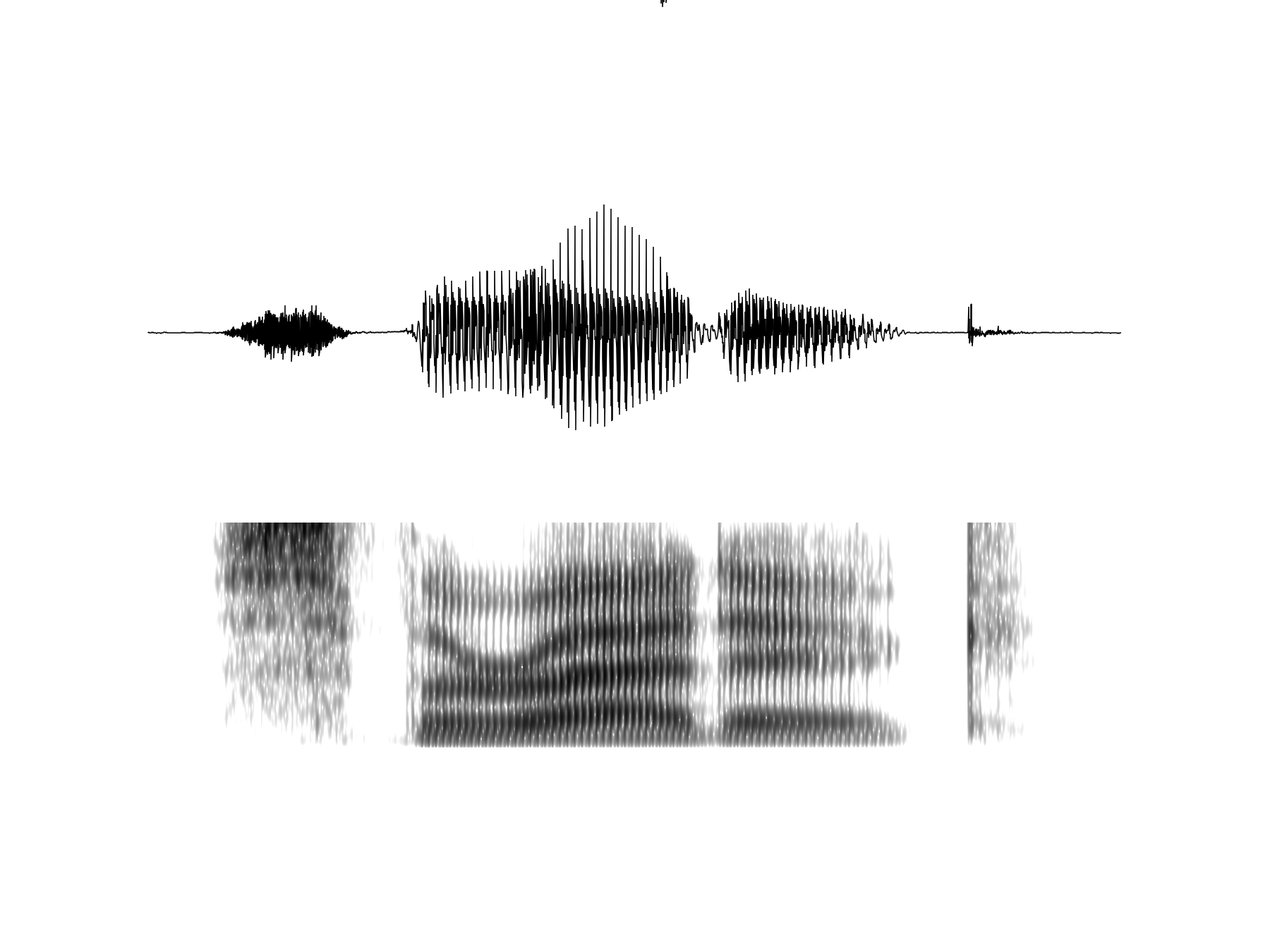
## 2 Results and Evaluation

The final result of my synthesis is acceptable according to my classmate's correct perception percentage. there was one case where the final release of [k] had been perceived as [ŋ], which suggested that the final burst was not as clear as expected. The improvement should be made on the spectral shape of the /pəɹæ/ segment, where the overall unusual spikes (see below) make the waveform very different from the original one. However, the intelligibility was not affected too much by the unusual shape. I have tried to use TL to adjust the shape, but the overall amplitude of this segment had been damped prominently, which was not as good as the unaltered one. In addition, the final release of [k] also need also to be adjusted to make it more natural. The burst duration and amplitude of aspiration should be increased to be perceived successfully.

A close up of a tree

Description automatically generated

synthesized spectrogram



original spectrogram

References

Halle, M., Hughes, G. W., & Radley, J. P. (1957). Acoustic properties of stop consonants. The Journal of the Acoustical Society of America, 29(1), 107-116.

Kent, R. D., Read, C., & Kent, R. D. (1992). The acoustic analysis of speech (Vol. 58). San Diego: Singular Publishing Group.

Klatt, D. H., & Klatt, L. (1990). Description of the cascade/parallel formant synthesizer. Unpublished manuscript.

Appendix

Final Doc of Synthesis Parameters

Synthesis specification for file: 'finalone.wav'

SenSyn Version 1.1 Sensimetrics Corporation

Max output signal (overload if greater than 0.0 dB) is -90.3 dB

Total number of waveform samples = 9000

CURRENT CONFIGURATION:

60 parameters

SYM V/C MIN VAL MAX DESCRIPTION

----------------------------------------------

DU C 30 900 5000 Duration of the utterance, in msec

UI C 1 5 20 Update interval for parameter reset, in msec

SR C 5000 10000 20000 Output sampling rate, in samples/sec

NF C 1 5 6 Number of formants in cascade branch

SS C 1 2 3 Source switch (1=impulse, 2=natural, 3=LF model)

RS C 1 8 8191 Random seed (initial value of random # generator)

SB C 0 1 1 Same noise burst, reset RS if AF=AH=0, 0=no,1=yes

CP C 0 0 1 0=Cascade, 1=Parallel tract excitation by AV

OS C 0 0 20 Output selector (0=normal,1=voicing source,...)

GV C 0 60 80 Overall gain scale factor for AV, in dB

GH C 0 60 80 Overall gain scale factor for AH, in dB

GF C 0 60 80 Overall gain scale factor for AF, in dB

F0 V 0 1000 5000 Fundamental frequency, in tenths of a Hz

AV V 0 60 80 Amplitude of voicing, in dB

OQ v 10 50 99 Open quotient (voicing open-time/period), in %

SQ v 100 200 500 Speed quotient (rise/fall time, LF model), in %

TL v 0 0 41 Extra tilt of voicing spectrum, dB down @ 3 kHz

FL v 0 0 100 Flutter (random fluct in f0), in % of maximum

DI v 0 0 100 Diplophonia (alt periods closer), in % of max

AH V 0 0 80 Amplitude of aspiration, in dB

AF V 0 0 80 Amplitude of frication, in dB

F1 V 0 500 1300 Frequency of 1st formant, in Hz

B1 v 30 60 1000 Bandwidth of 1st formant, in Hz

DF1 v 0 0 100 Change in F1 during open portion of period, in Hz

DB1 v 0 0 400 Change in B1 during open portion of period, in Hz

F2 V 0 1500 3000 Frequency of 2nd formant, in Hz

B2 v 40 90 1000 Bandwidth of 2nd formant, in Hz

F3 V 0 2500 4800 Frequency of 3rd formant, in Hz

B3 v 60 150 1000 Bandwidth of 3rd formant, in Hz

F4 V 0 3250 4990 Frequency of 4th formant, in Hz

B4 v 100 200 1000 Bandwidth of 4th formant, in Hz

F5 V 0 3700 4990 Frequency of 5th formant, in Hz

B5 v 100 200 1500 Bandwidth of 5th formant, in Hz

F6 V 0 4990 6000 Frequency of 6th formant, in Hz (applies if NF=6)

B6 v 100 500 4000 Bandwidth of 6th formant, in Hz (applies if NF=6)

FNP v 180 500 2000 Frequency of nasal pole, in Hz

BNP v 40 90 1000 Bandwidth of nasal pole, in Hz

FNZ v 180 500 2000 Frequency of nasal zero, in Hz

BNZ v 40 90 1000 Bandwidth of nasal zero, in Hz

FTP v 300 2150 3000 Frequency of tracheal pole, in Hz

BTP v 40 180 1000 Bandwidth of tracheal pole, in Hz

FTZ v 300 2150 3000 Frequency of tracheal zero, in Hz

BTZ v 40 180 2000 Bandwidth of tracheal zero, in Hz

A2F V 0 0 80 Amp of fric-excited parallel 2nd formant, in dB

A3F V 0 0 80 Amp of fric-excited parallel 3rd formant, in dB

A4F V 0 0 80 Amp of fric-excited parallel 4th formant, in dB

A5F V 0 0 80 Amp of fric-excited parallel 5th formant, in dB

A6F V 0 0 80 Amp of fric-excited parallel 6th formant, in dB

AB V 0 0 80 Amp of fric-excited parallel bypass path, in dB

B2F v 40 250 1000 Bw of fric-excited parallel 2nd formant, in Hz

B3F v 60 300 1000 Bw of fric-excited parallel 3rd formant, in Hz

B4F v 100 320 1000 Bw of fric-excited parallel 4th formant, in Hz

B5F v 100 360 1500 Bw of fric-excited parallel 5th formant, in Hz

B6F v 100 1500 4000 Bw of fric-excited parallel 6th formant, in Hz

ANV v 0 0 80 Amp of voice-excited parallel nasal form., in dB

A1V v 0 60 80 Amp of voice-excited parallel 1st formant, in dB

A2V v 0 60 80 Amp of voice-excited parallel 2nd formant, in dB

A3V v 0 60 80 Amp of voice-excited parallel 3rd formant, in dB

A4V v 0 60 80 Amp of voice-excited parallel 4th formant, in dB

ATV v 0 0 80 Amp of voice-excited par tracheal formant, in dB

Varied Parameters:

time F0 AV AH AF F1 F2 F3 F4 F5 F6 A2F A3F A4F A5F A6F AB

0 1000 0 0 0 637 1702 2766 3660 4500 6000 0 0 0 50 60 0

5 1011 0 0 3 650 1704 2764 3665 4505 5982 0 0 0 50 60 0

10 1022 1 0 6 663 1707 2763 3670 4511 5964 0 0 0 50 60 0

15 1033 2 0 10 676 1710 2762 3675 4516 5946 0 0 0 50 60 0

20 1044 3 0 13 689 1713 2760 3681 4522 5928 0 0 0 50 60 0

25 1055 4 0 16 702 1694 2759 3686 4528 5910 0 0 0 50 60 0

30 1066 5 0 20 715 1675 2758 3691 4533 5892 0 0 0 50 60 0

35 1078 6 0 23 729 1656 2756 3696 4539 5874 0 0 0 50 60 0

40 1089 7 0 27 742 1637 2755 3702 4544 5856 0 0 0 50 60 0

45 1100 7 0 30 755 1619 2754 3707 4550 5839 0 0 0 50 60 0

50 1111 8 0 33 768 1600 2752 3712 4556 5821 0 0 0 50 60 0

55 1122 9 0 37 781 1581 2751 3717 4561 5803 0 0 0 50 60 0

60 1133 10 0 40 794 1562 2750 3723 4567 5785 0 0 0 50 60 0

65 1145 11 0 43 808 1544 2748 3728 4572 5767 0 0 0 50 60 0

70 1156 12 0 47 821 1525 2747 3733 4578 5749 0 0 0 50 60 0

75 1167 13 0 50 834 1506 2746 3739 4584 5731 0 0 0 50 60 0

80 1178 14 0 54 847 1487 2744 3744 4589 5713 0 0 0 50 60 0

85 1189 14 0 57 860 1469 2743 3749 4595 5695 0 0 0 50 60 0

90 1200 15 0 60 873 1450 2742 3754 4600 5678 0 0 0 50 60 0

95 1210 16 0 60 887 1431 2723 3712 4590 5660 0 0 0 50 60 0

100 1220 17 0 60 901 1412 2704 3670 4580 5642 0 0 0 50 60 0

105 1230 18 0 60 915 1394 2685 3628 4570 5624 0 0 0 50 60 0

110 1240 19 0 60 930 1375 2666 3586 4560 5606 0 0 0 50 60 0

115 1250 20 0 60 944 1356 2647 3544 4550 5589 0 0 0 50 60 0

120 1260 21 0 60 958 1337 2628 3502 4540 5571 0 0 0 50 60 0

125 1270 21 0 60 973 1318 2609 3460 4530 5553 0 0 0 50 60 0

130 1280 22 0 60 987 1300 2590 3418 4520 5535 0 0 0 50 60 0

135 1290 23 0 60 1001 1281 2571 3376 4510 5517 0 0 0 50 60 0

140 1300 24 0 30 1015 1262 2553 3335 4500 5500 0 0 0 50 60 0

145 1308 25 0 0 500 1243 0 0 0 0 4 4 0 25 30 0

150 1316 26 0 2 400 1225 0 0 0 0 8 8 0 0 0 2

155 1325 27 0 4 300 1206 0 0 0 0 12 12 0 0 0 4

160 1333 28 0 6 298 1187 0 0 0 0 16 16 0 0 0 6

165 1342 28 0 8 297 1168 0 0 0 0 21 21 0 0 0 8

170 1350 29 0 10 296 1150 0 0 0 0 25 25 0 0 0 10

175 1358 30 0 12 295 1131 0 0 0 0 29 29 0 0 0 12

180 1367 31 0 15 294 1112 0 0 0 0 33 33 0 0 0 15

185 1375 32 0 17 293 1093 0 0 0 0 38 38 0 0 0 17

190 1384 33 0 19 292 1075 0 0 0 0 42 42 0 0 0 19

195 1392 34 0 21 291 1056 0 0 0 0 46 46 0 0 0 21

200 1400 35 0 23 290 1037 0 0 0 0 50 50 0 0 0 23

205 1376 35 0 25 290 1018 0 0 0 0 50 50 0 0 0 25

210 1352 65 0 50 200 1000 2681 3702 0 0 50 50 0 0 0 30

215 1328 65 0 0 303 1122 2631 3652 0 0 50 50 0 0 0 45

220 1304 65 0 0 407 1244 2581 3602 0 0 0 0 0 0 0 60

225 1280 65 0 0 410 1255 2518 3578 0 0 0 0 0 0 0 55

230 1278 65 0 0 414 1266 2455 3554 0 0 0 0 0 0 0 50

235 1276 65 0 0 417 1277 2393 3530 0 0 0 0 0 0 0 35

240 1275 66 0 0 421 1289 2330 3506 0 0 0 0 0 0 0 20

245 1273 66 0 0 424 1300 2267 3482 0 0 0 0 0 0 0 10

250 1272 66 0 0 428 1311 2205 3458 0 0 0 0 0 0 0 0

255 1270 66 0 0 431 1322 2142 3434 0 0 0 0 0 0 0 0

260 1269 66 0 0 435 1334 2079 3410 0 0 0 0 0 0 0 0

265 1267 67 0 0 438 1345 2017 3386 0 0 0 0 0 0 0 0

270 1266 67 0 0 442 1356 1954 3362 0 0 0 0 0 0 0 0

275 1264 67 0 0 445 1367 1892 3338 0 0 0 0 0 0 0 0

280 1263 67 0 0 442 1362 1844 3330 0 0 0 0 0 0 0 0

285 1261 67 0 0 439 1358 1797 3323 0 0 0 0 0 0 0 0

290 1260 68 0 0 440 1346 1776 3302 0 0 0 0 0 0 0 0

295 1258 68 0 0 441 1334 1755 3282 0 0 0 0 0 0 0 0

300 1256 68 0 0 442 1322 1734 3262 0 0 0 0 0 0 0 0

305 1255 68 0 0 443 1310 1714 3242 0 0 0 0 0 0 0 0

310 1253 68 0 0 460 1320 1729 3250 0 0 0 0 0 0 0 0

315 1252 69 0 0 460 1320 1744 3255 0 0 0 0 0 0 0 0

320 1250 69 0 0 480 1400 1759 3280 0 0 0 0 0 0 0 0

325 1249 69 0 0 493 1419 1806 3292 0 0 0 0 0 0 0 0

330 1247 69 0 0 507 1438 1854 3305 0 0 0 0 0 0 0 0

335 1246 69 0 0 521 1457 1902 3318 0 0 0 0 0 0 0 0

340 1244 70 0 0 535 1477 1949 3331 0 0 0 0 0 0 0 0

345 1243 70 0 0 549 1496 2004 3344 0 0 0 0 0 0 0 0

350 1241 70 0 0 563 1515 2059 3357 0 0 0 0 0 0 0 0

355 1240 70 0 0 576 1535 2114 3370 0 0 0 0 0 0 0 0

360 1242 70 0 0 590 1554 2169 3383 0 0 0 0 0 0 0 0

365 1244 70 0 0 604 1573 2225 3396 0 0 0 0 0 0 0 0

370 1246 70 0 0 618 1593 2280 3409 0 0 0 0 0 0 0 0

375 1249 71 0 0 632 1612 2335 3422 0 0 0 0 0 0 0 0

380 1251 71 0 0 646 1631 2390 3434 0 0 0 0 0 0 0 0

385 1253 72 0 0 659 1650 2445 3447 0 0 0 0 0 0 0 0

390 1256 72 0 0 653 1652 2455 3447 0 0 0 0 0 0 0 0

395 1258 73 0 0 647 1654 2465 3448 0 0 0 0 0 0 0 0

400 1260 73 0 0 642 1656 2475 3449 0 0 0 0 0 0 0 0

405 1262 74 0 0 636 1658 2485 3449 0 0 0 0 0 0 0 0

410 1265 74 0 0 631 1661 2495 3450 0 0 0 0 0 0 0 0

415 1267 75 0 0 625 1663 2506 3451 0 0 0 0 0 0 0 0

420 1269 75 0 0 620 1665 2516 3451 0 0 0 0 0 0 0 0

425 1272 74 0 0 614 1667 2526 3452 0 0 0 0 0 0 0 0

430 1274 74 0 0 609 1670 2536 3453 0 0 0 0 0 0 0 0

435 1276 74 0 0 603 1672 2546 3453 0 0 0 0 0 0 0 0

440 1278 74 0 0 598 1674 2557 3454 0 0 0 0 0 0 0 0

445 1281 74 0 0 592 1676 2567 3455 0 0 0 0 0 0 0 0

450 1283 74 0 0 587 1679 2577 3455 0 0 0 0 0 0 0 0

455 1285 73 0 0 581 1681 2587 3456 0 0 0 0 0 0 0 0

460 1288 73 0 0 576 1683 2597 3457 0 0 0 0 0 0 0 0

465 1290 73 0 0 570 1685 2608 3457 0 0 0 0 0 0 0 0

470 1292 73 0 0 565 1688 2618 3458 0 0 0 0 0 0 0 0

475 1294 73 0 0 559 1690 2628 3459 0 0 0 0 0 0 0 0

480 1297 73 0 0 554 1692 2638 3459 0 0 0 0 0 0 0 0

485 1299 70 0 0 548 1694 2648 3460 0 0 0 0 0 0 0 0

490 1301 68 0 0 543 1696 2659 3461 0 0 0 0 0 0 0 0

495 1304 62 0 0 537 1699 2669 3461 0 0 0 0 0 0 0 0

500 1306 56 0 0 532 1701 2679 3462 0 0 0 0 0 0 0 0

505 1308 51 0 0 526 1703 2689 3463 0 0 0 0 0 0 0 0

510 1310 45 0 0 521 1705 2699 3463 0 0 0 0 0 0 0 0

515 1293 40 0 0 0 0 2699 3593 0 0 0 0 0 0 0 0

520 1276 30 0 0 0 0 2721 3675 0 0 0 0 0 0 0 0

525 1260 25 0 0 0 0 2743 3757 0 0 0 0 0 0 0 0

530 1257 20 0 0 0 0 2765 3840 0 0 0 0 0 0 0 0

535 1254 15 0 0 0 0 2787 3922 0 0 0 0 0 0 0 0

540 1252 10 0 0 115 821 2797 3945 0 0 0 0 0 0 0 0

545 1249 65 0 0 230 1642 2808 3968 0 0 0 0 0 0 0 0

550 1246 64 0 0 318 1693 2809 3948 0 0 0 0 0 0 0 0

555 1244 64 0 0 407 1745 2811 3929 0 0 0 0 0 0 0 0

560 1241 64 0 0 411 1752 2796 3909 0 0 0 0 0 0 0 0

565 1238 63 0 0 415 1759 2782 3890 0 0 0 0 0 0 0 0

570 1236 63 0 0 419 1766 2768 3870 0 0 0 0 0 0 0 0

575 1233 63 0 0 424 1773 2754 3851 0 0 0 0 0 0 0 0

580 1230 63 0 0 428 1780 2740 3831 0 0 0 0 0 0 0 0

585 1228 62 0 0 432 1787 2726 3812 0 0 0 0 0 0 0 0

590 1225 62 0 0 436 1794 2712 3792 0 0 0 0 0 0 0 0

595 1222 62 0 0 441 1801 2697 3773 0 0 0 0 0 0 0 0

600 1220 62 0 0 445 1808 2683 3753 0 0 0 0 0 0 0 0

605 1210 62 0 0 449 1815 2669 3734 0 0 0 0 0 0 0 0

610 1200 61 0 0 453 1822 2655 3714 0 0 0 0 0 0 0 0

615 1190 61 0 0 458 1830 2641 3695 0 0 0 0 0 0 0 0

620 1180 61 0 0 462 1837 2627 3675 0 0 0 0 0 0 0 0

625 1170 61 0 0 466 1844 2613 3656 0 0 0 0 0 0 0 0

630 1160 61 0 0 471 1851 2598 3636 0 0 0 0 0 0 0 0

635 1150 60 0 0 475 1858 2584 3617 0 0 0 0 0 0 0 0

640 1140 60 0 0 479 1865 2570 3597 0 0 0 0 0 0 0 0

645 1130 60 0 0 483 1872 2556 3578 0 0 0 0 0 0 0 0

650 1120 60 0 0 488 1879 2542 3558 0 0 0 0 0 0 0 0

655 1110 60 0 0 492 1886 2528 3539 0 0 0 0 0 0 0 0

660 1100 59 0 0 496 1893 2514 3519 0 0 0 0 0 0 0 0

665 1090 59 0 0 500 1900 2500 3500 0 0 0 0 0 0 0 0

670 1080 59 0 0 484 1903 2489 3505 0 0 0 0 0 0 0 0

675 1070 58 0 0 468 1906 2479 3511 0 0 0 0 0 0 0 0

680 1060 58 0 0 452 1910 2468 3517 0 0 0 0 0 0 0 0

685 1050 58 0 0 436 1913 2458 3523 0 0 0 0 0 0 0 0

690 1040 58 0 0 420 1917 2448 3529 0 0 0 0 0 0 0 0

695 1030 57 0 0 404 1920 2437 3535 0 0 0 0 0 0 0 0

700 1039 57 0 0 388 1924 2427 3541 0 0 0 0 0 0 0 0

705 1048 57 0 0 372 1927 2417 3547 0 0 0 0 0 0 0 0

710 1057 56 0 0 357 1931 2406 3553 0 0 0 0 0 0 0 0

715 1067 56 0 0 341 1934 2396 3559 0 0 0 0 0 0 0 0

720 1076 56 0 0 325 1938 2386 3565 0 0 0 0 0 0 0 0

725 1085 56 0 0 309 1941 2375 3571 0 0 0 0 0 0 0 0

730 1095 51 0 0 293 1945 2365 3577 0 0 0 0 0 0 0 0

735 1104 50 0 0 277 1948 2355 3583 0 0 0 0 0 0 0 0

740 1113 49 0 0 261 1951 2344 3589 0 0 0 0 0 0 0 0

745 1123 48 0 0 245 1955 2334 3594 0 0 0 0 0 0 0 0

750 1132 35 3 0 230 1958 2324 3600 0 0 0 0 0 0 0 0

755 1141 0 6 0 0 1956 2324 0 0 0 0 0 0 0 0 0

760 1150 0 9 0 0 1954 2324 250 0 0 0 0 0 0 0 0

765 1131 0 13 0 0 1952 2324 500 0 0 0 0 0 0 0 0

770 1112 0 16 0 0 1950 2324 750 0 0 0 0 0 0 0 0

775 1093 0 19 0 0 1948 2324 1000 0 0 0 0 0 0 0 0

780 1075 0 22 0 0 1946 2324 1250 0 0 0 0 0 0 0 0

785 1056 0 26 0 0 1944 2324 1500 0 0 0 0 0 0 0 0

790 1037 0 29 0 0 1942 2324 1750 0 0 0 0 0 0 0 0

795 1018 0 32 0 0 1940 2324 2000 0 0 0 0 0 0 0 0

800 1000 25 36 0 0 1938 2324 2250 0 0 0 0 0 0 0 0

805 1000 25 39 0 0 1936 2324 2500 0 0 0 0 0 0 0 0

810 1000 25 42 0 0 1934 2324 2750 0 0 0 0 0 0 0 0

815 1000 25 45 0 0 1932 2324 3000 0 0 0 0 0 0 0 0

820 1000 30 60 63 0 1930 2324 0 0 0 50 50 50 0 0 63

825 1000 30 60 65 300 1928 2500 3600 0 0 48 47 50 0 0 63

830 1000 30 30 0 300 1926 2478 3600 0 0 47 45 50 0 0 63

835 1000 30 20 0 300 1924 2457 3600 0 0 46 42 50 0 0 63

840 1000 30 20 0 300 1922 2435 3600 0 0 45 40 50 0 0 63

845 987 26 0 0 300 1920 2414 3600 0 0 43 37 50 0 0 0

850 975 22 0 0 300 1918 2392 3600 0 0 42 35 50 0 0 0

855 962 18 0 0 300 1916 2371 3600 0 0 41 32 50 0 0 0

860 950 15 0 0 300 1914 2350 3600 0 0 40 30 50 0 0 0

865 937 11 0 0 300 1912 2328 3600 0 0 38 27 50 0 0 0

870 925 7 0 0 300 1910 2307 3600 0 0 37 25 50 0 0 0

875 912 3 0 0 300 1908 2285 3600 0 0 36 22 50 0 0 0

880 900 0 0 0 300 1906 2264 3600 0 0 35 20 50 0 0 0

885 900 0 0 0 300 1904 2242 3600 0 0 0 0 0 0 0 0

890 900 0 0 0 300 1902 2221 3600 0 0 0 0 0 0 0 0

895 900 0 0 0 300 1900 2200 3600 0 0 0 0 0 0 0 0