Hyperspectral Data Analysis Tutorial: From Spectral Reflectance to Plant Classification

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1 Overview

This tutorial demonstrates how to analyze hyperspectral data for plant classification and biomarker estimation. We'll work with spectral reflectance data from plant samples collected in different months (March and July) across various plant groups and classes. The analysis includes data preprocessing, visualization, statistical testing, and machine learning classification using both raw spectral data and derived vegetation indices.

2 Prerequisites

Before starting, you'll need to install and load several R packages for data manipulation, visualization, and machine learning.

```
# Install required packages (uncomment if needed)
# install.packages(c("tidyverse", "ggpubr", "dplyr", "caret", "ggplot2",
#                     "patchwork", "ggforce", "pls"))
#
# # Install BiocManager and mixOmics for advanced multivariate analysis
# install.packages("BiocManager")
# BiocManager::install("mixOmics")

# Load libraries
library(tidyverse)
library(ggpubr)
library(dplyr)
library(caret)
library(ggplot2)
library(patchwork)
library(ggforce)
library(pls)
library(mixOmics)
```

3 Part 1: Data Preparation and Exploration

3.1 Loading and Inspecting the Data

First, we load our hyperspectral dataset and examine its structure:

```
# Load the hyperspectral data
data <- read.csv("SamplesForWorkshop.csv")

# Inspect the basic structure
head(data)
```

```
  Month       Group SampleN Class       Chla       Chlb          C    Antho
1 March Deciduous     101   SP1 0.04112532 0.01990401 0.02018104 0.001240
2 March Deciduous     103   SP1 0.03786589 0.01835909 0.01925522 0.000829
3 March Deciduous     106   SP1 0.06864117 0.03369560 0.02865739 0.000932
4 March Deciduous     107   SP1 0.09533804 0.04758828 0.04024224 0.000903
5 March Deciduous     108   SP1 0.05198037 0.02378042 0.02842488 0.000441
6 March Deciduous     109   SP1 0.03009055 0.01016909 0.01941967 0.000037
    Cellulose     Wax       X400       X401       X402       X403       X404
1          NA      NA 0.01935004 0.01953985 0.01971527 0.01990466 0.02013160
```

```
2 0.02858881 0.00138 0.02714292 0.02732804 0.02751218 0.02771258 0.02794536
3        NA       NA 0.03921675 0.03947513 0.03973155 0.04001420 0.04034739
4 0.02790119 0.00132 0.07315494 0.07358253 0.07399735 0.07442525 0.07488811
5 0.02567766 0.00159 0.04725425 0.04754305 0.04782556 0.04812899 0.04847630
6        NA       NA 0.12793647 0.12843469 0.12890088 0.12936994 0.12988197
         X405       X406       X407       X408       X409       X410       X411
1 0.02035488 0.02059546 0.02085226 0.02109311 0.02135383 0.02163444 0.02190610
2 0.02818707 0.02844890 0.02872564 0.02899116 0.02927687 0.02958125 0.02987978
3 0.04068215 0.04104167 0.04142650 0.04180553 0.04220256 0.04262228 0.04304760
4 0.07534337 0.07581604 0.07630594 0.07677775 0.07726508 0.07776967 0.07826895
5 0.04883025 0.04920400 0.04959861 0.04999560 0.05041397 0.05085308 0.05129193
6 0.13043007 0.13095214 0.13144691 0.13196342 0.13249848 0.13304018 0.13356059
         X412       X413       X414       X415       X416       X417       X418
1 0.02221011 0.02251458 0.02279541 0.02310002 0.02339607 0.02367869 0.02398703
2 0.03020467 0.03053133 0.03084428 0.03118415 0.03151645 0.03183377 0.03217116
3 0.04350703 0.04397479 0.04443063 0.04492492 0.04542020 0.04590918 0.04643361
4 0.07879445 0.07931892 0.07982211 0.08035397 0.08087857 0.08138906 0.08192764
5 0.05176315 0.05224110 0.05270597 0.05320045 0.05369293 0.05417969 0.05469803
6 0.13412063 0.13467893 0.13520641 0.13576781 0.13633660 0.13691414 0.13753684
         X419       X420       X421       X422       X423       X424       X425
1 0.02427381 0.02455196 0.02486009 0.02515035 0.02543658 0.02573736 0.02602904
2 0.03249130 0.03280808 0.03315602 0.03348747 0.03381189 0.03414418 0.03447253
3 0.04693940 0.04744091 0.04798031 0.04851171 0.04904831 0.04960776 0.05016710
4 0.08244260 0.08294885 0.08348895 0.08400678 0.08452091 0.08505194 0.08557103
5 0.05520135 0.05570128 0.05623246 0.05675378 0.05727661 0.05781279 0.05834057
6 0.13813736 0.13873743 0.13938635 0.14000262 0.14062263 0.14127799 0.14189400
         X426       X427       X428       X429       X430       X431       X432
1 0.02633240 0.02664981 0.02695262 0.02725680 0.02756162 0.02784997 0.02815090
2 0.03481485 0.03517162 0.03551564 0.03585602 0.03619869 0.03653811 0.03688240
3 0.05073984 0.05132854 0.05191080 0.05249704 0.05308565 0.05365726 0.05424623
4 0.08610410 0.08665505 0.08719010 0.08772440 0.08825830 0.08877337 0.08930471
5 0.05888448 0.05944755 0.06000196 0.06056132 0.06112509 0.06167483 0.06223856
6 0.14251268 0.14314862 0.14377245 0.14439682 0.14501745 0.14561361 0.14622418
         X433       X434       X435       X436       X437       X438       X439
1 0.02844733 0.02871732 0.02899621 0.02926406 0.02951482 0.02976654 0.03000130
2 0.03721809 0.03752958 0.03784823 0.03815578 0.03844714 0.03874017 0.03901499
3 0.05483282 0.05539401 0.05596640 0.05652527 0.05706367 0.05760274 0.05812002
4 0.08983342 0.09033656 0.09084651 0.09134187 0.09181806 0.09229675 0.09275467
5 0.06279857 0.06333242 0.06387047 0.06439384 0.06489903 0.06540657 0.06589426
6 0.14684625 0.14746523 0.14807761 0.14867846 0.14926778 0.14986202 0.15043423
         X440       X441       X442       X443       X444       X445       X446
1 0.03022378 0.03045670 0.03066583 0.03086380 0.03106426 0.03125323 0.03143343
2 0.03927746 0.03955081 0.03979762 0.04003266 0.04026939 0.04049301 0.04070630
```

```
3 0.05862248 0.05913533 0.05961537 0.06007704 0.06053737 0.06098135 0.06141280
4 0.09319738 0.09364816 0.09407106 0.09448226 0.09489797 0.09529830 0.09568947
5 0.06636785 0.06685087 0.06730394 0.06774164 0.06817934 0.06859946 0.06900603
6 0.15099403 0.15157372 0.15212991 0.15267159 0.15321472 0.15373664 0.15423986
          X447       X448       X449       X450       X451       X452       X453
1 0.03160678 0.03177016 0.03193078 0.03208827 0.03222623 0.03235938 0.03248433
2 0.04091086 0.04110392 0.04129274 0.04147732 0.04164264 0.04180018 0.04194841
3 0.06183247 0.06223458 0.06262734 0.06301102 0.06336615 0.06370694 0.06403086
4 0.09607749 0.09645768 0.09683522 0.09720841 0.09755666 0.09790018 0.09823436
5 0.06940082 0.06978288 0.07015444 0.07051584 0.07085315 0.07117767 0.07148797
6 0.15473623 0.15522725 0.15570309 0.15616346 0.15659580 0.15702646 0.15744415
          X454       X455       X456       X457       X458       X459       X460
1 0.03259777 0.03270355 0.03279493 0.03287399 0.03295469 0.03302413 0.03308214
2 0.04208489 0.04221327 0.04232604 0.04242432 0.04251981 0.04260353 0.04267660
3 0.06433452 0.06462206 0.06488672 0.06512871 0.06535944 0.06557048 0.06576277
4 0.09855452 0.09886604 0.09916220 0.09944367 0.09972454 0.09999212 0.10024606
5 0.07178139 0.07205818 0.07231306 0.07254708 0.07277323 0.07298244 0.07317451
6 0.15782994 0.15821661 0.15859072 0.15893968 0.15928531 0.15961765 0.15993420
          X461       X462       X463       X464       X465       X466       X467
1 0.03314035 0.03318075 0.03321191 0.03324401 0.03326302 0.03327627 0.03328663
2 0.04274887 0.04280121 0.04284312 0.04288396 0.04291389 0.04293851 0.04295846
3 0.06594956 0.06610895 0.06624917 0.06638198 0.06649481 0.06659587 0.06668905
4 0.10050059 0.10073738 0.10096501 0.10119443 0.10141143 0.10162390 0.10183454
5 0.07335979 0.07352207 0.07366912 0.07381013 0.07393478 0.07405040 0.07415867
6 0.16024905 0.16054250 0.16082257 0.16110253 0.16137175 0.16163146 0.16188311
          X468       X469       X470       X471       X472       X473       X474
1 0.03328572 0.03328360 0.03327942 0.03325993 0.03324008 0.03322019 0.03319141
2 0.04296756 0.04297400 0.04297720 0.04296716 0.04295607 0.04294586 0.04292946
3 0.06676503 0.06683290 0.06689222 0.06693193 0.06696780 0.06700177 0.06702491
4 0.10203511 0.10223468 0.10243287 0.10261624 0.10279920 0.10298142 0.10315436
5 0.07425305 0.07433964 0.07441911 0.07448338 0.07454417 0.07460329 0.07465536
6 0.16211634 0.16234598 0.16257220 0.16278866 0.16300705 0.16322076 0.16341805
          X475       X476       X477       X478       X479       X480       X481
1 0.03315672 0.03312528 0.03309402 0.03306275 0.03302952 0.03299827 0.03298125
2 0.04291011 0.04289380 0.04287823 0.04286197 0.04284618 0.04283446 0.04283638
3 0.06704180 0.06705974 0.06707642 0.06709659 0.06711958 0.06715074 0.06720119
4 0.10332524 0.10349882 0.10367215 0.10385007 0.10403183 0.10421980 0.10442182
5 0.07470269 0.07475113 0.07479897 0.07484540 0.07489147 0.07494316 0.07500806
6 0.16362549 0.16383586 0.16404634 0.16426934 0.16450230 0.16474095 0.16498637
          X482       X483       X484       X485       X486       X487       X488
1 0.03296834 0.03296581 0.03298070 0.03300814 0.03305567 0.03313353 0.03324139
2 0.04284438 0.04286510 0.04290444 0.04295983 0.04303663 0.04314459 0.04328303
3 0.06726473 0.06735215 0.06747331 0.06762502 0.06781736 0.06806194 0.06836069
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	X489	X490	X491	X492	X493	X494	X495
4	0.10462415	0.10482973	0.10504559	0.10526514	0.10549450	0.10574149	0.10600244
5	0.07507672	0.07515590	0.07525459	0.07536760	0.07550128	0.07566519	0.07585836
6	0.16524045	0.16551036	0.16580101	0.16610292	0.16642214	0.16676024	0.16711334

	X489	X490	X491	X492	X493	X494	X495
1	0.03338612	0.03356970	0.03378639	0.03404992	0.03436064	0.03472231	0.03513950
2	0.04345692	0.04366934	0.04391749	0.04421183	0.04455379	0.04494638	0.04539129
3	0.06872313	0.06915435	0.06965070	0.07022844	0.07089030	0.07163941	0.07248259
4	0.10628220	0.10658198	0.10689163	0.10722155	0.10757111	0.10794102	0.10833666
5	0.07608779	0.07635640	0.07665867	0.07700521	0.07739686	0.07783699	0.07832994
6	0.16749401	0.16790846	0.16834174	0.16879895	0.16928230	0.16979253	0.17033839

	X496	X497	X498	X499	X500	X501	X502
1	0.03560990	0.03613468	0.03671916	0.03736106	0.03806023	0.03882021	0.03963254
2	0.04588726	0.04643720	0.04704618	0.04771096	0.04843066	0.04920727	0.05003558
3	0.07341723	0.07444642	0.07557656	0.07680449	0.07812985	0.07955492	0.08107200
4	0.10875365	0.10919023	0.10965236	0.11013607	0.11064058	0.11117119	0.11172116
5	0.07887310	0.07946817	0.08011868	0.08082296	0.08158091	0.08239451	0.08325833
6	0.17091689	0.17152505	0.17216127	0.17282570	0.17351807	0.17423688	0.17498291

	X503	X504	X505	X506	X507	X508	X509
1	0.04049833	0.04142326	0.04239581	0.04341520	0.04448254	0.04559354	0.04675167
2	0.05091607	0.05185096	0.05283091	0.05385613	0.05492759	0.05604131	0.05719918
3	0.08268176	0.08438701	0.08617603	0.08804767	0.09000178	0.09203059	0.09413773
4	0.11229111	0.11288637	0.11349679	0.11412320	0.11476832	0.11542677	0.11610403
5	0.08417261	0.08513983	0.08615217	0.08720769	0.08830702	0.08944674	0.09062927
6	0.17575778	0.17656009	0.17737808	0.17821800	0.17908056	0.17996109	0.18086071

	X510	X511	X512	X513	X514	X515	X516
1	0.04795406	0.04919390	0.05047649	0.05179715	0.05314824	0.05454081	0.05596931
2	0.05839841	0.05963178	0.06090477	0.06221383	0.06355253	0.06492882	0.06633843
3	0.09632019	0.09856892	0.10088933	0.10327509	0.10571713	0.10822504	0.11079292
4	0.11679860	0.11750173	0.11822144	0.11895455	0.11969333	0.12044907	0.12121734
5	0.09185071	0.09310403	0.09439600	0.09572170	0.09707399	0.09846202	0.09988068
6	0.18177733	0.18270507	0.18365183	0.18461317	0.18558374	0.18657422	0.18757854

	X517	X518	X519	X520	X521	X522	X523
1	0.05743014	0.05892587	0.06044898	0.06199831	0.06357670	0.06517468	0.06678904
2	0.06777761	0.06924808	0.07074252	0.07226019	0.07380275	0.07536206	0.07693521
3	0.11341546	0.11609412	0.11881962	0.12158840	0.12439965	0.12724068	0.13010579
4	0.12199319	0.12278132	0.12357738	0.12438125	0.12519726	0.12601836	0.12684417
5	0.10132745	0.10280355	0.10430285	0.10582377	0.10736836	0.10892744	0.11049900
6	0.18858772	0.18960786	0.19063684	0.19167322	0.19272670	0.19377947	0.19482882

	X524	X525	X526	X527	X528	X529	X530
1	0.06842049	0.07005782	0.07169722	0.07333847	0.07497556	0.07660855	0.07823144
2	0.07852235	0.08011438	0.08170718	0.08330079	0.08488893	0.08647200	0.08804548
3	0.13299465	0.13589120	0.13878835	0.14168368	0.14456889	0.14744160	0.15029370
4	0.12767909	0.12851378	0.12934713	0.13018153	0.13100967	0.13183633	0.13265983

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5 0.11208442 0.11367269 0.11525937 0.11684433 0.11842287 0.11999527 0.12155680
6 0.19588770 0.19694358 0.19800017 0.19906253 0.20011992 0.20117538 0.20222528
          X531       X532       X533       X534       X535       X536       X537
1 0.07983068 0.08140800 0.08295962 0.08447338 0.08594693 0.08737618 0.08875065
2 0.08959678 0.09112861 0.09263689 0.09410910 0.09554301 0.09693588 0.09827883
3 0.15310702 0.15588259 0.15861267 0.16128067 0.16388038 0.16640404 0.16883883
4 0.13346989 0.13427428 0.13507296 0.13585736 0.13663047 0.13739183 0.13813606
5 0.12309509 0.12461238 0.12610462 0.12756079 0.12897941 0.13035736 0.13168693
6 0.20326114 0.20429691 0.20533149 0.20634760 0.20735659 0.20835044 0.20932198
          X538       X539       X540       X541       X542       X543       X544
1 0.09007066 0.09132833 0.09251491 0.09363218 0.09467167 0.09563026 0.09650712
2 0.09957227 0.10080930 0.10198207 0.10308948 0.10412609 0.10509025 0.10597804
3 0.17118110 0.17342029 0.17554547 0.17755537 0.17943739 0.18118701 0.18280088
4 0.13886841 0.13958395 0.14027753 0.14095531 0.14160913 0.14223827 0.14284380
5 0.13296912 0.13419580 0.13535883 0.13646058 0.13749311 0.13845423 0.13934146
6 0.21028405 0.21122553 0.21214223 0.21304296 0.21391497 0.21475614 0.21557769
          X545       X546       X547       X548       X549       X550       X551
1 0.09729736 0.09800073 0.09861799 0.09914597 0.09958819 0.09994599 0.1002133
2 0.10678839 0.10751995 0.10817273 0.10874500 0.10923990 0.10965923 0.1099983
3 0.18427231 0.18560104 0.18678858 0.18782892 0.18872666 0.18948538 0.1900992
4 0.14342177 0.14397324 0.14450222 0.14500662 0.14549055 0.14595565 0.1463971
5 0.14015219 0.14088553 0.14154244 0.14212270 0.14262960 0.14306374 0.1434226
6 0.21637635 0.21715257 0.21790458 0.21862851 0.21933109 0.22001644 0.2206835
          X552       X553       X554       X555       X556       X557       X558
1 0.1003935 0.1004846 0.1004865 0.1004123 0.1002587 0.1000211 0.09971299
2 0.1102589 0.1104382 0.1105395 0.1105731 0.1105356 0.1104227 0.11024613
3 0.1905716 0.1909003 0.1910838 0.1911384 0.1910632 0.1908548 0.19053151
4 0.1468172 0.1472128 0.1475806 0.1479320 0.1482618 0.1485630 0.14884634
5 0.1437079 0.1439166 0.1440490 0.1441151 0.1441137 0.1440413 0.14390884
6 0.2213325 0.2219603 0.2225593 0.2231397 0.2237014 0.2242453 0.22477078
          X559       X560       X561       X562       X563       X564       X565
1 0.09933828 0.09890037 0.09841199 0.09787353 0.09728819 0.0966660 0.09600756
2 0.11001127 0.10972239 0.10938866 0.10901069 0.10859124 0.1081393 0.10765661
3 0.19010117 0.18957083 0.18895472 0.18825803 0.18748608 0.1866521 0.18576039
4 0.14910994 0.14935198 0.14958116 0.14979458 0.14999341 0.1501885 0.15037506
5 0.14372122 0.14348127 0.14319656 0.14287065 0.14250678 0.1421147 0.14169350
6 0.22527251 0.22575154 0.22622148 0.22667856 0.22711893 0.2275559 0.22798592
          X566       X567       X568       X569       X570       X571       X572
1 0.0953187 0.09460856 0.09387488 0.09312381 0.09235903 0.0915783 0.09078713
2 0.1071480 0.10662053 0.10607110 0.10550653 0.10492906 0.1043389 0.10373915
3 0.1848186 0.18383831 0.18281949 0.18176961 0.18069376 0.1795934 0.17847469
4 0.1505548 0.15073296 0.15090362 0.15107045 0.15123427 0.1513907 0.15154636
5 0.1412489 0.14078817 0.14030809 0.13981442 0.13931027 0.1387946 0.13827238
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6 0.2284066 0.22882282 0.22923719 0.22965335 0.23006862 0.2304766 0.23088345
          X573        X574        X575        X576        X577        X578        X579
1 0.08998989 0.08918627 0.08837639 0.0875620 0.08673794 0.08590883 0.08507519
2 0.10313219 0.10251788 0.10189710 0.1012715 0.10063717 0.09999579 0.09934682
3 0.17733994 0.17618776 0.17502001 0.1738392 0.17264083 0.17142886 0.17020330
4 0.15170370 0.15185876 0.15201300 0.1521658 0.15230956 0.15245171 0.15259070
5 0.13774622 0.13721567 0.13668100 0.1361442 0.13559956 0.13505092 0.13449783
6 0.23128432 0.23167988 0.23207552 0.2324687 0.23284516 0.23321113 0.23356522
          X580        X581        X582        X583        X584        X585        X586
1 0.08423442 0.08339191 0.08254314 0.08168885 0.08083518 0.07998049 0.07913056
2 0.09868668 0.09802123 0.09734707 0.09666412 0.09597616 0.09528402 0.09459183
3 0.16895963 0.16770276 0.16642946 0.16514068 0.16384561 0.16254440 0.16124282
4 0.15272001 0.15284467 0.15295790 0.15305902 0.15315574 0.15324376 0.15332634
5 0.13393577 0.13336844 0.13279310 0.13220991 0.13162423 0.13103515 0.13044699
6 0.23389787 0.23421943 0.23452461 0.23480638 0.23507286 0.23532043 0.23554751
          X587        X588        X589        X590        X591        X592        X593
1 0.07829192 0.07746219 0.07664425 0.07584181 0.07505744 0.07429519 0.07355722
2 0.09390339 0.09321798 0.09253823 0.09186542 0.09120355 0.09055697 0.08992752
3 0.15994782 0.15865842 0.15738035 0.15611837 0.15487734 0.15366283 0.15247821
4 0.15340786 0.15348293 0.15355352 0.15362164 0.15368608 0.15375111 0.15381777
5 0.12986288 0.12928283 0.12870933 0.12814448 0.12759149 0.12705325 0.12653144
6 0.23575827 0.23595809 0.23614420 0.23631011 0.23645720 0.23659022 0.23671187
          X594        X595        X596        X597        X598        X599        X600
1 0.07284646 0.07216642 0.07151574 0.07089362 0.07030504 0.06974702 0.06921568
2 0.08931751 0.08873009 0.08816391 0.08761912 0.08710161 0.08660975 0.08614028
3 0.15132541 0.15021165 0.14913693 0.14810055 0.14710894 0.14615933 0.14524822
4 0.15388383 0.15395281 0.15402229 0.15409064 0.15416450 0.15424019 0.15431408
5 0.12602994 0.12555047 0.12509221 0.12465610 0.12424521 0.12385751 0.12349041
6 0.23682290 0.23692661 0.23702057 0.23710248 0.23718169 0.23725679 0.23733062
          X601        X602        X603        X604        X605        X606        X607
1 0.06871590 0.06824427 0.06779756 0.06738121 0.06698668 0.06661267 0.06626059
2 0.08569751 0.08527906 0.08488176 0.08450861 0.08415350 0.08381590 0.08349534
3 0.14438170 0.14355674 0.14277109 0.14203052 0.14132434 0.14065096 0.14001293
4 0.15439231 0.15447189 0.15455103 0.15463629 0.15471997 0.15480330 0.15489100
5 0.12314853 0.12282877 0.12252844 0.12225219 0.12199245 0.12174815 0.12151939
6 0.23740941 0.23748006 0.23754232 0.23761146 0.23767472 0.23773446 0.23779928
          X608        X609        X610        X611        X612        X613        X614
1 0.06592067 0.06558971 0.06526421 0.06493810 0.06461066 0.06427819 0.06393197
2 0.08318374 0.08287863 0.08257468 0.08226595 0.08195216 0.08162940 0.08128922
3 0.13939799 0.13880093 0.13821549 0.13762883 0.13703893 0.13644150 0.13582623
4 0.15497546 0.15505725 0.15513584 0.15520278 0.15525885 0.15530252 0.15532532
5 0.12129988 0.12108714 0.12087566 0.12065788 0.12043223 0.12019528 0.11994098
6 0.23785228 0.23789162 0.23792255 0.23793600 0.23793459 0.23791419 0.23786265
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	X615	X616	X617	X618	X619	X620	X621
1	0.06358066	0.06322342	0.06285737	0.06249485	0.06212614	0.06173983	0.06135371
2	0.08094070	0.08058392	0.08021755	0.07985044	0.07947363	0.07907801	0.07867894
3	0.13520367	0.13457474	0.13393675	0.13329916	0.13265220	0.13198332	0.13130937
4	0.15533995	0.15534804	0.15535069	0.15535461	0.15534750	0.15531579	0.15528064
5	0.11967837	0.11940827	0.11913167	0.11885445	0.11856691	0.11825899	0.11794650
6	0.23779301	0.23770446	0.23759900	0.23748382	0.23735406	0.23720535	0.23704775

	X622	X623	X624	X625	X626	X627	X628
1	0.06096021	0.06055303	0.06014036	0.05972088	0.05929428	0.05885934	0.05841278
2	0.07827233	0.07785212	0.07742189	0.07698397	0.07653698	0.07607897	0.07560705
3	0.13062312	0.12991854	0.12919951	0.12846513	0.12771424	0.12694536	0.12615061
4	0.15523545	0.15517517	0.15510717	0.15503021	0.15494452	0.15485119	0.15474421
5	0.11762366	0.11728635	0.11693924	0.11658384	0.11621957	0.11584560	0.11545783
6	0.23687331	0.23668197	0.23649327	0.23629002	0.23606648	0.23583166	0.23557785

	X629	X630	X631	X632	X633	X634	X635
1	0.05795527	0.05748603	0.05699905	0.05650005	0.05599486	0.05547741	0.05495620
2	0.07512177	0.07462112	0.07410139	0.07356649	0.07302071	0.07245999	0.07188949
3	0.12533078	0.12448352	0.12360051	0.12268882	0.12175537	0.12079126	0.11980974
4	0.15462406	0.15448973	0.15433557	0.15416411	0.15398004	0.15377545	0.15356198
5	0.11505497	0.11463491	0.11419517	0.11373754	0.11326686	0.11277786	0.11227915
6	0.23530354	0.23500961	0.23468886	0.23434428	0.23397961	0.23358799	0.23318067

	X636	X637	X638	X639	X640	X641	X642
1	0.05443225	0.05389784	0.05336307	0.05282777	0.05229352	0.05176013	0.05122040
2	0.07131240	0.07072248	0.07012878	0.06953031	0.06892856	0.06832109	0.06770344
3	0.11881379	0.11779566	0.11676895	0.11573201	0.11468328	0.11362447	0.11254781
4	0.15334130	0.15310487	0.15286143	0.15260838	0.15234640	0.15207773	0.15179375
5	0.11177324	0.11125371	0.11072784	0.11019465	0.10965544	0.10911002	0.10855271
6	0.23275858	0.23231537	0.23185519	0.23138106	0.23088842	0.23039152	0.22988007

	X643	X644	X645	X646	X647	X648	X649
1	0.05067407	0.05012335	0.04955918	0.04898233	0.04840086	0.04779901	0.04717507
2	0.06707542	0.06643656	0.06577792	0.06509982	0.06441092	0.06369708	0.06295571
3	0.11145095	0.11033256	0.10918132	0.10799627	0.10678372	0.10552384	0.10421461
4	0.15149331	0.15117764	0.15083604	0.15047160	0.15010365	0.14972120	0.14932322
5	0.10798253	0.10739743	0.10678900	0.10615856	0.10551948	0.10485815	0.10417231
6	0.22935259	0.22881438	0.22824662	0.22765027	0.22704086	0.22640183	0.22572700

	X650	X651	X652	X653	X654	X655	X656
1	0.04653323	0.04585823	0.04515682	0.04443386	0.04366012	0.04284885	0.04200633
2	0.06218923	0.06138614	0.06055072	0.05968850	0.05877776	0.05783281	0.05686229
3	0.10286037	0.10144457	0.09997440	0.09845845	0.09687142	0.09523283	0.09355612
4	0.14890973	0.14846591	0.14800004	0.14752001	0.14700833	0.14648099	0.14594347
5	0.10346322	0.10271373	0.10193070	0.10112215	0.10026296	0.09936838	0.09844702
6	0.22501592	0.22426560	0.22347971	0.22266645	0.22182519	0.22096547	0.22009041

	X657	X658	X659	X660	X661	X662	X663

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1 0.04112904 0.04023311 0.03932314 0.03840480 0.03749374 0.03659878 0.03573640
2 0.05586505 0.05485753 0.05384766 0.05284544 0.05186887 0.05092658 0.05003479
3 0.09184547 0.09012778 0.08841595 0.08672569 0.08508418 0.08351003 0.08202960
4 0.14539015 0.14483941 0.14429285 0.14375646 0.14324636 0.14276567 0.14232405
5 0.09749722 0.09653743 0.09557408 0.09461768 0.09368849 0.09279759 0.09196144
6 0.21919617 0.21831512 0.21745210 0.21661292 0.21582388 0.21508127 0.21439568
          X664       X665       X666       X667       X668       X669       X670
1 0.03491957 0.03415902 0.03346817 0.03286250 0.03234755 0.03193791 0.03164808
2 0.04920909 0.04846061 0.04780149 0.04724780 0.04680634 0.04648941 0.04631164
3 0.08066669 0.07943710 0.07836182 0.07746325 0.07675204 0.07624717 0.07596878
4 0.14193399 0.14159507 0.14131449 0.14110551 0.14096741 0.14090971 0.14094403
5 0.09119393 0.09050558 0.08991020 0.08942397 0.08905594 0.08881727 0.08872087
6 0.21379672 0.21328021 0.21285802 0.21255501 0.21236926 0.21230197 0.21236356
          X671       X672       X673       X674       X675       X676       X677
1 0.03148418 0.03145749 0.03157734 0.03184520 0.03227017 0.03286057 0.03364198
2 0.04628252 0.04640921 0.04669839 0.04715049 0.04777247 0.04857174 0.04957799
3 0.07593105 0.07614409 0.07661637 0.07735295 0.07836611 0.07966270 0.08127560
4 0.14107033 0.14129381 0.14161705 0.14203747 0.14256147 0.14319371 0.14394922
5 0.08877884 0.08899779 0.08938175 0.08993245 0.09065555 0.09155918 0.09267125
6 0.21256576 0.21291668 0.21342337 0.21408473 0.21491094 0.21590651 0.21707382
          X678       X679       X680       X681       X682       X683       X684
1 0.03463591 0.03584559 0.03727959 0.03890853 0.04074332 0.04280010 0.04512443
2 0.05081183 0.05227443 0.05396643 0.05584926 0.05792813 0.06021686 0.06275996
3 0.08322588 0.08551391 0.08814309 0.09107320 0.09430706 0.09785603 0.10176922
4 0.14484534 0.14588311 0.14706177 0.14835480 0.14975763 0.15127407 0.15293975
5 0.09401102 0.09558227 0.09739100 0.09939306 0.10159130 0.10399691 0.10665264
6 0.21842124 0.21994332 0.22163039 0.22347487 0.22547610 0.22763919 0.22998649
          X685       X686       X687       X688       X689       X690       X691
1 0.04770666 0.05055014 0.05366235 0.05705577 0.06074399 0.06473969 0.06904089
2 0.06554579 0.06857070 0.07183574 0.07535084 0.07912241 0.08315618 0.08744854
3 0.10602924 0.11063112 0.11557245 0.12085837 0.12649542 0.13248772 0.13882248
4 0.15474306 0.15668255 0.15875819 0.16096905 0.16332018 0.16581730 0.16844999
5 0.10954807 0.11268212 0.11605181 0.11966772 0.12353529 0.12765937 0.13203657
6 0.23250101 0.23517890 0.23801942 0.24101073 0.24416033 0.24747015 0.25092949
          X692       X693       X694       X695       X696       X697       X698
1 0.07364648 0.07855259 0.08376598 0.08930171 0.09515985 0.1013342 0.1078190
2 0.09199278 0.09677994 0.10181091 0.10709589 0.11263135 0.1184081 0.1244159
3 0.14549170 0.15248177 0.15978967 0.16742315 0.17537189 0.1836173 0.1921429
4 0.17121771 0.17411562 0.17714253 0.18031221 0.18362171 0.1870588 0.1906138
5 0.13666145 0.14152539 0.14662758 0.15198014 0.15758110 0.1634179 0.1694773
6 0.25454083 0.25829748 0.26219713 0.26624524 0.27043564 0.2747524 0.2791927
         X699      X700      X701      X702      X703      X704      X705
1 0.1146002 0.1216785 0.1290585 0.1367157 0.1446407 0.1528259 0.1612537
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2 0.1306410 0.1370806 0.1437330 0.1505758 0.1576007 0.1647943 0.1721407
3 0.2009259 0.2099575 0.2192333 0.2287205 0.2384021 0.2482600 0.2582699
4 0.1942770 0.1980494 0.2019431 0.2059352 0.2100195 0.2141936 0.2184426
5 0.1757474 0.1822278 0.1889204 0.1958030 0.2028659 0.2100975 0.2174809
6 0.2837450 0.2883928 0.2931410 0.2979729 0.3028781 0.3078592 0.3128863
        X706      X707      X708      X709      X710      X711      X712
1 0.1699117 0.1787820 0.1878580 0.1971244 0.2065590 0.2161479 0.2258751
2 0.1796269 0.1872352 0.1949583 0.2027826 0.2106901 0.2186685 0.2267003
3 0.2684121 0.2786675 0.2890200 0.2994509 0.3099345 0.3204523 0.3309849
4 0.2227589 0.2271384 0.2315708 0.2360486 0.2405646 0.2451082 0.2496727
5 0.2250026 0.2326493 0.2404120 0.2482772 0.2562268 0.2642490 0.2723273
6 0.3179542 0.3230646 0.3281924 0.3333331 0.3384819 0.3436190 0.3487389
        X713      X714      X715      X716      X717      X718      X719
1 0.2357180 0.2456495 0.2556491 0.2656726 0.2756102 0.2853785 0.2949762
2 0.2347653 0.2428437 0.2509181 0.2589484 0.2668298 0.2744867 0.2819258
3 0.3415060 0.3519866 0.3624061 0.3727160 0.3828074 0.3926027 0.4020992
4 0.2542484 0.2588198 0.2633840 0.2679156 0.2723533 0.2766654 0.2808546
5 0.2804415 0.2885732 0.2967058 0.3047984 0.3127451 0.3204750 0.3279954
6 0.3538326 0.3588799 0.3638808 0.3688203 0.3736662 0.3784098 0.3830407
        X720      X721      X722      X723      X724      X725      X726
1 0.3047581 0.3147987 0.3249689 0.3350107 0.3450484 0.3549433 0.3646082
2 0.2895005 0.2972874 0.3051587 0.3128546 0.3204935 0.3279494 0.3351457
3 0.4116320 0.4212867 0.4309326 0.4403080 0.4495156 0.4584360 0.4669960
4 0.2851008 0.2894699 0.2938883 0.2981989 0.3024676 0.3066284 0.3106459
5 0.3356434 0.3435202 0.3515018 0.3593217 0.3670711 0.3746326 0.3819343
6 0.3875930 0.3920907 0.3964942 0.4007472 0.4048756 0.4088452 0.4126453
        X727      X728      X729      X730      X731      X732      X733
1 0.3739904 0.3830997 0.3919521 0.4005579 0.4089125 0.4170193 0.4248626
2 0.3420412 0.3486535 0.3550057 0.3611153 0.3669933 0.3726491 0.3780731
3 0.4751516 0.4829244 0.4903429 0.4974261 0.5041820 0.5106298 0.5167665
4 0.3145036 0.3181990 0.3217475 0.3251642 0.3284541 0.3316335 0.3346991
5 0.3889334 0.3956472 0.4021010 0.4083143 0.4142940 0.4200561 0.4255948
6 0.4162819 0.4197415 0.4230380 0.4261839 0.4291843 0.4320482 0.4347777
        X734      X735      X736      X737      X738      X739      X740
1 0.4324299 0.4397447 0.4467963 0.4535734 0.4600851 0.4663293 0.4723054
2 0.3832615 0.3882394 0.3930022 0.3975459 0.4018829 0.4060149 0.4099445
3 0.5225899 0.5281361 0.5334047 0.5383951 0.5431298 0.5476138 0.5518514
4 0.3376391 0.3404769 0.3432092 0.3458251 0.3483425 0.3507596 0.3530698
5 0.4309007 0.4360024 0.4408948 0.4455739 0.4500550 0.4543403 0.4584308
6 0.4373782 0.4398667 0.4422441 0.4445040 0.4466689 0.4487346 0.4506987
        X741      X742      X743      X744      X745      X746      X747
1 0.4780133 0.4834517 0.4886197 0.4935208 0.4981515 0.5025081 0.5065939
2 0.4136740 0.4172043 0.4205365 0.4236794 0.4266295 0.4293861 0.4319570
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3 0.5558495 0.5596129 0.5631465 0.5664602 0.5695533 0.5724259 0.5750845
4 0.3552846 0.3574007 0.3594121 0.3613334 0.3631579 0.3648851 0.3665223
5 0.4623273 0.4660297 0.4695400 0.4728670 0.4760079 0.4789598 0.4817272
6 0.4525751 0.4543585 0.4560499 0.4576652 0.4591941 0.4606440 0.4620251
          X748      X749      X750      X751      X752      X753      X754
1 0.5104147 0.5139803 0.5172945 0.5203587 0.5231843 0.5257801 0.5281511
2 0.4343442 0.4365579 0.4386060 0.4404891 0.4422152 0.4437923 0.4452263
3 0.5775365 0.5797950 0.5818670 0.5837594 0.5854799 0.5870371 0.5884412
4 0.3680650 0.3695210 0.3708975 0.3721860 0.3733947 0.3745316 0.3755906
5 0.4843151 0.4867328 0.4889857 0.4910764 0.4930094 0.4947937 0.4964318
6 0.4633229 0.4645444 0.4656941 0.4667718 0.4677835 0.4687333 0.4696092
          X755      X756      X757      X758      X759      X760      X761
1 0.5303160 0.5322863 0.5340784 0.5356773 0.5370817 0.5383194 0.5393959
2 0.4465360 0.4477333 0.4488306 0.4498029 0.4506426 0.4513744 0.4519997
3 0.5897125 0.5908655 0.5919160 0.5928359 0.5936188 0.5942888 0.5948510
4 0.3765860 0.3775263 0.3784158 0.3792412 0.3799915 0.3806728 0.3812888
5 0.4979409 0.4993331 0.5006240 0.5017857 0.5028093 0.5037172 0.5045065
6 0.4704292 0.4711990 0.4719063 0.4725627 0.4731685 0.4737228 0.4742444
          X762      X763      X764      X765      X766      X767      X768
1 0.5403643 0.5412332 0.5420227 0.5427022 0.5432836 0.5437767 0.5442078
2 0.4525716 0.4530974 0.4535932 0.4540224 0.4543935 0.4547064 0.4549866
3 0.5953622 0.5958299 0.5962733 0.5966480 0.5969623 0.5972212 0.5974527
4 0.3818723 0.3824277 0.3829774 0.3834863 0.3839550 0.3843913 0.3848059
5 0.5052341 0.5059090 0.5065475 0.5071134 0.5076113 0.5080405 0.5084315
6 0.4747396 0.4752009 0.4756483 0.4760612 0.4764436 0.4768120 0.4771616
          X769      X770      X771      X772      X773      X774      X775
1 0.5445850 0.5449138 0.5451692 0.5453618 0.5455106 0.5456709 0.5458501
2 0.4552401 0.4554719 0.4556495 0.4557798 0.4558831 0.4560069 0.4561603
3 0.5976611 0.5978486 0.5979820 0.5980709 0.5981358 0.5982316 0.5983625
4 0.3852036 0.3855922 0.3859441 0.3862702 0.3865895 0.3869153 0.3872581
5 0.5087890 0.5091156 0.5093846 0.5096017 0.5097842 0.5099839 0.5102136
6 0.4774960 0.4778318 0.4781525 0.4784607 0.4787665 0.4790722 0.4793798
          X776      X777      X778      X779      X780      X781      X782
1 0.5460466 0.5462603 0.5464840 0.5467089 0.5469122 0.5470225 0.5471111
2 0.4563430 0.4565523 0.4567810 0.4570192 0.4572393 0.4573655 0.4574716
3 0.5985222 0.5987101 0.5989173 0.5991311 0.5993211 0.5994205 0.5995033
4 0.3876177 0.3879815 0.3883541 0.3887302 0.3890857 0.3893977 0.3897024
5 0.5104708 0.5107494 0.5110443 0.5113453 0.5116245 0.5118134 0.5119853
6 0.4796894 0.4799966 0.4803092 0.4806172 0.4809125 0.4812042 0.4814970
          X783      X784      X785      X786      X787      X788      X789
1 0.5473274 0.5475590 0.5477471 0.5478551 0.5479617 0.5481059 0.5482870
2 0.4577071 0.4579659 0.4581848 0.4583210 0.4584553 0.4586245 0.4588289
3 0.5997205 0.5999526 0.6001394 0.6002456 0.6003530 0.6004961 0.6006763
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4 0.3900746 0.3904517 0.3908001 0.3911030 0.3914126 0.3917378 0.3920809
5 0.5122899 0.5126105 0.5128867 0.5130828 0.5132821 0.5135136 0.5137774
6 0.4818135 0.4821479 0.4824713 0.4827741 0.4830792 0.4833899 0.4837129
          X790      X791      X792      X793      X794      X795      X796
1 0.5484659 0.5486377 0.5488059 0.5489882 0.5491802 0.5493663 0.5495433
2 0.4590338 0.4592296 0.4594213 0.4596289 0.4598524 0.4600704 0.4602746
3 0.6008543 0.6010229 0.6011882 0.6013705 0.6015657 0.6017540 0.6019299
4 0.3924291 0.3927669 0.3931029 0.3934544 0.3938063 0.3941547 0.3944995
5 0.5140415 0.5142999 0.5145563 0.5148275 0.5151159 0.5153973 0.5156632
6 0.4840408 0.4843631 0.4846871 0.4850153 0.4853422 0.4856727 0.4860035
          X797      X798      X799      X800      X801      X802      X803
1 0.5497489 0.5500854 0.5506642 0.5515202 0.5522710 0.5527613 0.5530416
2 0.4605024 0.4608594 0.4614521 0.4623035 0.4630374 0.4634979 0.4637363
3 0.6021261 0.6024475 0.6030013 0.6038157 0.6045241 0.6049592 0.6051650
4 0.3948515 0.3952742 0.3958213 0.3964996 0.3971246 0.3975828 0.3978918
5 0.5159554 0.5163729 0.5170153 0.5179132 0.5187043 0.5192090 0.5194696
6 0.4863303 0.4866713 0.4870351 0.4874267 0.4878189 0.4881670 0.4884546
          X804      X805      X806      X807      X808      X809      X810
1 0.5533323 0.5534704 0.5535479 0.5536253 0.5537523 0.5539153 0.5541222
2 0.4639833 0.4640865 0.4641344 0.4641896 0.4642996 0.4644500 0.4646483
3 0.6053734 0.6054511 0.6054833 0.6055226 0.6056155 0.6057448 0.6059218
4 0.3982102 0.3984523 0.3986621 0.3988849 0.3991400 0.3994186 0.3997250
5 0.5197187 0.5198326 0.5198972 0.5199726 0.5201061 0.5202804 0.5205082
6 0.4887556 0.4890253 0.4892767 0.4895663 0.4898620 0.4901558 0.4904752
          X811      X812      X813      X814      X815      X816      X817
1 0.5543595 0.5545936 0.5547842 0.5550261 0.5553192 0.5556482 0.5559185
2 0.4648795 0.4651044 0.4652817 0.4655191 0.4658096 0.4661311 0.4663948
3 0.6061306 0.6063378 0.6065057 0.6067273 0.6070022 0.6073135 0.6075616
4 0.4000461 0.4003673 0.4006722 0.4009941 0.4013429 0.4017117 0.4020416
5 0.5207665 0.5210200 0.5212268 0.5214943 0.5218185 0.5221764 0.5224726
6 0.4907891 0.4910998 0.4914256 0.4917523 0.4920857 0.4924302 0.4927551
          X818      X819      X820      X821      X822      X823      X824
1 0.5561700 0.5564189 0.5566672 0.5569069 0.5571387 0.5573621 0.5575732
2 0.4666380 0.4668789 0.4671243 0.4673598 0.4675846 0.4678011 0.4680087
3 0.6077924 0.6080216 0.6082502 0.6084726 0.6086891 0.6088986 0.6090967
4 0.4023686 0.4026980 0.4030207 0.4033464 0.4036624 0.4039629 0.4042741
5 0.5227444 0.5230096 0.5232811 0.5235431 0.5237943 0.5240352 0.5242683
6 0.4930817 0.4934086 0.4937322 0.4940582 0.4943813 0.4947020 0.4950278
          X825      X826      X827      X828      X829      X830      X831
1 0.5577775 0.5579958 0.5582742 0.5585726 0.5588624 0.5591402 0.5594079
2 0.4682077 0.4684161 0.4686917 0.4689870 0.4692735 0.4695468 0.4698048
3 0.6092877 0.6094925 0.6097610 0.6100498 0.6103301 0.6105993 0.6108592
4 0.4045806 0.4048859 0.4052295 0.4055752 0.4059105 0.4062541 0.4065833
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5 0.5244956 0.5247365 0.5250444 0.5253695 0.5256813 0.5259842 0.5262725
6 0.4953522 0.4956768 0.4960185 0.4963487 0.4966646 0.4969939 0.4973127
          X832      X833      X834      X835      X836      X837      X838
1 0.5596642 0.5599035 0.5601399 0.5603725 0.5605976 0.5608466 0.5610874
2 0.4700479 0.4702734 0.4705007 0.4707301 0.4709566 0.4712002 0.4714323
3 0.6111070 0.6113418 0.6115777 0.6118113 0.6120353 0.6122840 0.6125221
4 0.4069013 0.4072110 0.4075150 0.4078233 0.4081315 0.4084465 0.4087589
5 0.5265441 0.5267968 0.5270489 0.5273044 0.5275565 0.5278252 0.5280807
6 0.4976285 0.4979620 0.4982734 0.4985897 0.4989185 0.4992426 0.4995697
          X839      X840      X841      X842      X843      X844      X845
1 0.5613206 0.5615652 0.5618042 0.5620462 0.5623050 0.5625539 0.5627802
2 0.4716558 0.4718898 0.4721204 0.4723577 0.4726092 0.4728496 0.4730658
3 0.6127504 0.6129881 0.6132247 0.6134686 0.6137327 0.6139931 0.6142274
4 0.4090697 0.4093771 0.4096826 0.4099904 0.4103084 0.4106320 0.4109347
5 0.5283302 0.5285915 0.5288498 0.5291124 0.5293869 0.5296504 0.5298893
6 0.4998906 0.5002103 0.5005363 0.5008610 0.5011864 0.5015249 0.5018611
          X846      X847      X848      X849      X850      X851      X852
1 0.5629918 0.5632077 0.5634485 0.5637056 0.5639604 0.5641983 0.5644418
2 0.4732655 0.4734760 0.4737135 0.4739629 0.4742086 0.4744338 0.4746681
3 0.6144369 0.6146605 0.6149152 0.6151848 0.6154446 0.6156864 0.6159382
4 0.4112146 0.4115081 0.4118128 0.4121235 0.4124394 0.4127338 0.4130302
5 0.5301101 0.5303407 0.5306029 0.5308818 0.5311488 0.5313975 0.5316541
6 0.5022000 0.5025375 0.5028653 0.5031952 0.5035448 0.5038736 0.5041946
          X853      X854      X855      X856      X857      X858      X859
1 0.5646955 0.5649900 0.5652820 0.5655545 0.5658102 0.5660402 0.5662522
2 0.4749164 0.4751998 0.4754800 0.4757391 0.4759859 0.4762120 0.4764216
3 0.6162030 0.6165050 0.6168000 0.6170741 0.6173363 0.6175713 0.6177850
4 0.4133404 0.4136648 0.4139923 0.4143068 0.4146015 0.4148892 0.4151691
5 0.5319241 0.5322332 0.5325375 0.5328160 0.5330827 0.5333310 0.5335653
6 0.5045206 0.5048407 0.5051735 0.5055320 0.5058707 0.5061972 0.5065153
          X860      X861      X862      X863      X864      X865      X866
1 0.5664736 0.5667530 0.5671557 0.5675830 0.5678412 0.5680218 0.5681890
2 0.4766414 0.4769197 0.4773271 0.4777679 0.4780437 0.4782313 0.4783981
3 0.6180095 0.6183026 0.6187207 0.6191508 0.6193992 0.6195641 0.6197138
4 0.4154390 0.4157535 0.4161348 0.4165200 0.4168134 0.4170614 0.4172959
5 0.5338048 0.5341057 0.5345315 0.5349805 0.5352502 0.5354295 0.5355821
6 0.5068286 0.5071557 0.5074951 0.5078207 0.5081333 0.5084149 0.5086641
          X867      X868      X869      X870      X871      X872      X873
1 0.5684107 0.5686450 0.5688701 0.5690646 0.5692818 0.5695180 0.5697272
2 0.4786217 0.4788525 0.4790754 0.4793060 0.4795565 0.4798182 0.4800541
3 0.6199289 0.6201633 0.6203908 0.6205831 0.6207946 0.6210285 0.6212474
4 0.4175889 0.4178781 0.4181438 0.4184007 0.4186611 0.4189372 0.4192174
5 0.5358110 0.5360559 0.5362944 0.5365203 0.5367663 0.5370257 0.5372580
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6	0.5089531	0.5092337	0.5094912	0.5097938	0.5100425	0.5102553	0.5105186

	X874	X875	X876	X877	X878	X879	X880
1	0.5699170	0.5700819	0.5702303	0.5704277	0.5706186	0.5707901	0.5709833
2	0.4802665	0.4804487	0.4806160	0.4808505	0.4810877	0.4813029	0.4815320
3	0.6214401	0.6216050	0.6217597	0.6219682	0.6221780	0.6223640	0.6225542
4	0.4194629	0.4196868	0.4199008	0.4201457	0.4203975	0.4206347	0.4208550
5	0.5374626	0.5376332	0.5377900	0.5380158	0.5382368	0.5384330	0.5386463
6	0.5107432	0.5109581	0.5111998	0.5113888	0.5115655	0.5117565	0.5119675

	X881	X882	X883	X884	X885	X886	X887
1	0.5711515	0.5712850	0.5713714	0.5714502	0.5715304	0.5716253	0.5716843
2	0.4817326	0.4819002	0.4820398	0.4821605	0.4822741	0.4824066	0.4825026
3	0.6227144	0.6228420	0.6229319	0.6230098	0.6230845	0.6231759	0.6232418
4	0.4210782	0.4212874	0.4214519	0.4216263	0.4217929	0.4219595	0.4221469
5	0.5388212	0.5389607	0.5390810	0.5391739	0.5392568	0.5393619	0.5394351
6	0.5121778	0.5123609	0.5125177	0.5126815	0.5128265	0.5129691	0.5131503

	X888	X889	X890	X891	X892	X893	X894
1	0.5717355	0.5717884	0.5718199	0.5718362	0.5718574	0.5719486	0.5721247
2	0.4825811	0.4826513	0.4827074	0.4827447	0.4827873	0.4829178	0.4831259
3	0.6232868	0.6233159	0.6233511	0.6233784	0.6234166	0.6235317	0.6237345
4	0.4223241	0.4224851	0.4226541	0.4228072	0.4229631	0.4231962	0.4234331
5	0.5394937	0.5395464	0.5395749	0.5395938	0.5396334	0.5397510	0.5399740
6	0.5132973	0.5134298	0.5136176	0.5138057	0.5140116	0.5142363	0.5144667

	X895	X896	X897	X898	X899	X900	X901
1	0.5722952	0.5724559	0.5726913	0.5730161	0.5733443	0.5736306	0.5738428
2	0.4833321	0.4835750	0.4838746	0.4842634	0.4846659	0.4850202	0.4852869
3	0.6239286	0.6241060	0.6243926	0.6247769	0.6251522	0.6254823	0.6257256
4	0.4236553	0.4238947	0.4241090	0.4243865	0.4246960	0.4249255	0.4251478
5	0.5401916	0.5403967	0.5406965	0.5410793	0.5414471	0.5417603	0.5419874
6	0.5147134	0.5149614	0.5151585	0.5154162	0.5157198	0.5158539	0.5159340

	X902	X903	X904	X905	X906	X907	X908
1	0.5739588	0.5739411	0.5739534	0.5740142	0.5741044	0.5741570	0.5741690
2	0.4854577	0.4855103	0.4856005	0.4857434	0.4859214	0.4860756	0.4861985
3	0.6258530	0.6258191	0.6258288	0.6259127	0.6260563	0.6261254	0.6261390
4	0.4253232	0.4253475	0.4254524	0.4256042	0.4257527	0.4258863	0.4259728
5	0.5421240	0.5421450	0.5422019	0.5423135	0.5424696	0.5425673	0.5426153
6	0.5159830	0.5159828	0.5159959	0.5160341	0.5161034	0.5161629	0.5161967

	X909	X910	X911	X912	X913	X914	X915
1	0.5741923	0.5742237	0.5742721	0.5742909	0.5741869	0.5740926	0.5739747
2	0.4863405	0.4864550	0.4865844	0.4866987	0.4867139	0.4867369	0.4867267
3	0.6261699	0.6262175	0.6262837	0.6263216	0.6262377	0.6261528	0.6260504
4	0.4260550	0.4261971	0.4263173	0.4264062	0.4264576	0.4264694	0.4264475
5	0.5426837	0.5427544	0.5428389	0.5428990	0.5428385	0.5428026	0.5427374
6	0.5162199	0.5162029	0.5160844	0.5159546	0.5159679	0.5158467	0.5157251

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        X916       X917       X918       X919       X920       X921       X922
1 0.5738006 0.5736914 0.5735268 0.5732858 0.5730024 0.5726879 0.5723600
2 0.4866481 0.4866124 0.4865633 0.4865000 0.4863974 0.4862361 0.4860393
3 0.6259158 0.6258297 0.6257005 0.6255195 0.6252655 0.6249757 0.6246737
4 0.4264064 0.4263607 0.4262946 0.4262067 0.4260627 0.4259102 0.4257523
5 0.5425912 0.5425197 0.5424109 0.5422423 0.5420702 0.5418488 0.5415858
6 0.5157324 0.5155792 0.5154593 0.5154318 0.5151896 0.5149782 0.5148460
        X923       X924       X925       X926       X927       X928       X929
1 0.5720295 0.5716217 0.5711392 0.5705721 0.5699796 0.5693676 0.5687301
2 0.4858619 0.4856133 0.4853050 0.4849393 0.4845664 0.4841675 0.4837418
3 0.6243761 0.6240204 0.6236072 0.6231321 0.6226545 0.6221423 0.6215950
4 0.4255778 0.4253723 0.4251030 0.4247447 0.4244499 0.4241213 0.4237391
5 0.5413230 0.5410147 0.5406635 0.5402598 0.5398452 0.5394004 0.5389175
6 0.5147279 0.5145275 0.5143057 0.5141366 0.5137892 0.5134115 0.5130846
        X930       X931       X932       X933       X934       X935       X936
1 0.5680470 0.5672885 0.5664708 0.5656354 0.5648133 0.5639594 0.5630529
2 0.4832923 0.4827631 0.4821730 0.4815850 0.4810221 0.4804446 0.4798339
3 0.6210490 0.6204232 0.6197175 0.6189900 0.6183165 0.6176440 0.6169298
4 0.4233947 0.4229853 0.4225282 0.4220917 0.4216488 0.4211924 0.4207331
5 0.5384006 0.5378181 0.5371779 0.5365230 0.5359169 0.5353053 0.5346485
6 0.5127929 0.5124397 0.5120471 0.5116670 0.5112737 0.5108692 0.5104335
        X937       X938       X939       X940       X941       X942       X943
1 0.5621736 0.5612837 0.5603704 0.5594547 0.5582838 0.5571180 0.5559118
2 0.4792591 0.4786838 0.4780966 0.4774944 0.4765949 0.4756941 0.4747726
3 0.6162481 0.6155577 0.6148530 0.6141730 0.6132364 0.6122956 0.6113262
4 0.4202496 0.4197758 0.4193196 0.4188388 0.4180856 0.4173694 0.4166575
5 0.5340122 0.5333676 0.5327142 0.5320678 0.5311173 0.5301773 0.5292157
6 0.5099378 0.5094638 0.5090210 0.5085263 0.5079358 0.5073483 0.5067500
        X944       X945       X946       X947       X948       X949       X950
1 0.5546948 0.5535109 0.5523726 0.5512851 0.5502447 0.5492371 0.5482454
2 0.4738567 0.4729731 0.4721305 0.4713444 0.4706114 0.4699262 0.4692657
3 0.6103691 0.6094566 0.6086039 0.6078108 0.6070538 0.6063243 0.6056114
4 0.4159682 0.4153187 0.4147213 0.4141781 0.4136517 0.4131637 0.4127105
5 0.5282579 0.5273497 0.5265068 0.5257357 0.5249971 0.5242920 0.5236123
6 0.5061639 0.5055726 0.5050005 0.5044783 0.5039611 0.5034847 0.5030458
        X951       X952       X953       X954       X955       X956       X957
1 0.5472727 0.5462962 0.5453274 0.5443901 0.5434554 0.5425477 0.5416891
2 0.4685926 0.4679138 0.4672491 0.4666251 0.4660206 0.4654547 0.4649423
3 0.6049258 0.6042449 0.6035751 0.6029278 0.6022886 0.6016784 0.6011111
4 0.4122726 0.4118499 0.4114419 0.4110382 0.4106576 0.4103175 0.4100205
5 0.5229467 0.5222782 0.5216196 0.5209966 0.5203945 0.5198357 0.5193332
6 0.5025596 0.5021318 0.5017645 0.5013731 0.5010386 0.5007354 0.5004226
        X958       X959       X960       X961       X962       X963       X964
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1 0.5408195 0.5399700 0.5391671 0.5383698 0.5376078 0.5369062 0.5362986
2 0.4644084 0.4638914 0.4634221 0.4629606 0.4625388 0.4621707 0.4618680
3 0.6005258 0.5999574 0.5994370 0.5989285 0.5984509 0.5980274 0.5976886
4 0.4097166 0.4094235 0.4091638 0.4089392 0.4087295 0.4085450 0.4084351
5 0.5188068 0.5182987 0.5178422 0.5173923 0.5169881 0.5166466 0.5163710
6 0.5001703 0.4999504 0.4997546 0.4995759 0.4994289 0.4993179 0.4992563
          X965      X966      X967      X968      X969      X970      X971
1 0.5357563 0.5352591 0.5347915 0.5344138 0.5341242 0.5339244 0.5338384
2 0.4616352 0.4614490 0.4612819 0.4612033 0.4612193 0.4613302 0.4615425
3 0.5974271 0.5972184 0.5970353 0.5969276 0.5969213 0.5970259 0.5972160
4 0.4083704 0.4083424 0.4083482 0.4083786 0.4084628 0.4086157 0.4088127
5 0.5161823 0.5160513 0.5159427 0.5159212 0.5159929 0.5161642 0.5164578
6 0.4992489 0.4992898 0.4993669 0.4994540 0.4995882 0.4997825 0.4999717
          X972      X973      X974      X975      X976      X977      X978
1 0.5338464 0.5339246 0.5340223 0.5341647 0.5343486 0.5345538 0.5346701
2 0.4618500 0.4622278 0.4626052 0.4630342 0.4634913 0.4639120 0.4642539
3 0.5974838 0.5978099 0.5981414 0.5985027 0.5988933 0.5992957 0.5995556
4 0.4090681 0.4093634 0.4096209 0.4099260 0.4102686 0.4105956 0.4109321
5 0.5168378 0.5172702 0.5177100 0.5181714 0.5186531 0.5191366 0.5194921
6 0.5001705 0.5003756 0.5005786 0.5007757 0.5009705 0.5011611 0.5013855
          X979      X980      X981      X982      X983      X984      X985
1 0.5347468 0.5348361 0.5349679 0.5351662 0.5354764 0.5359803 0.5365235
2 0.4645464 0.4648304 0.4651541 0.4655465 0.4660499 0.4667270 0.4674257
3 0.5997526 0.5999543 0.6001823 0.6004742 0.6008829 0.6014979 0.6021262
4 0.4112422 0.4115276 0.4118864 0.4122502 0.4126619 0.4132610 0.4138312
5 0.5198009 0.5201334 0.5205113 0.5209499 0.5214928 0.5222041 0.5229338
6 0.5015529 0.5016432 0.5018792 0.5021846 0.5025440 0.5029740 0.5034106
          X986      X987      X988      X989      X990      X991      X992
1 0.5370762 0.5376438 0.5382783 0.5389358 0.5395885 0.5402430 0.5408698
2 0.4681203 0.4688171 0.4695617 0.4702967 0.4709933 0.4717121 0.4724053
3 0.6027315 0.6033076 0.6039679 0.6046447 0.6052940 0.6059258 0.6065206
4 0.4143711 0.4149265 0.4155088 0.4161121 0.4167223 0.4172757 0.4178176
5 0.5236495 0.5243461 0.5251114 0.5258830 0.5266208 0.5273521 0.5280431
6 0.5038346 0.5042344 0.5046427 0.5050517 0.5054668 0.5059265 0.5064767
          X993      X994      X995      X996      X997      X998      X999
1 0.5415051 0.5422563 0.5430057 0.5437643 0.5445651 0.5452872 0.5460034
2 0.4730936 0.4738672 0.4746321 0.4754113 0.4762429 0.4770158 0.4777519
3 0.6071124 0.6078055 0.6084949 0.6091796 0.6098745 0.6105060 0.6111171
4 0.4183688 0.4189393 0.4195342 0.4201448 0.4207520 0.4213427 0.4219227
5 0.5287273 0.5295137 0.5302710 0.5310319 0.5318544 0.5325831 0.5332918
6 0.5070639 0.5075118 0.5080610 0.5086241 0.5090463 0.5096053 0.5101258
         X1000     X1001     X1002     X1003     X1004     X1005     X1006
1 0.5467652 0.5475561 0.5483366 0.5490790 0.5497598 0.5504390 0.5511469
```

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2 0.4784714 0.4792079 0.4799577 0.4806888 0.4813334 0.4819714 0.4826270
3 0.6117413 0.6124202 0.6130965 0.6137342 0.6143086 0.6148675 0.6154373
4 0.4224961 0.4230999 0.4236866 0.4242377 0.4247581 0.4252564 0.4257779
5 0.5340234 0.5347326 0.5354444 0.5361421 0.5367780 0.5373879 0.5379935
6 0.5105307 0.5111330 0.5116991 0.5121697 0.5125911 0.5130571 0.5135117
        X1007       X1008       X1009       X1010       X1011       X1012       X1013
1 0.5519039 0.5526517 0.5533722 0.5540609 0.5547318 0.5554248 0.5561409
2 0.4833090 0.4839643 0.4845871 0.4851773 0.4857316 0.4863131 0.4869243
3 0.6160388 0.6166199 0.6171808 0.6177212 0.6182048 0.6187270 0.6193030
4 0.4263716 0.4268939 0.4274072 0.4279421 0.4284047 0.4288849 0.4293903
5 0.5386136 0.5392055 0.5397641 0.5402926 0.5407914 0.5413132 0.5418590
6 0.5138712 0.5143734 0.5149008 0.5153683 0.5157744 0.5161969 0.5166461
        X1014       X1015       X1016       X1017       X1018       X1019       X1020
1 0.5568585 0.5575652 0.5582695 0.5589916 0.5596644 0.5603185 0.5609733
2 0.4875190 0.4880863 0.4886349 0.4891833 0.4896746 0.4901288 0.4905627
3 0.6198997 0.6204637 0.6210085 0.6215693 0.6220844 0.6225850 0.6230875
4 0.4298643 0.4303352 0.4307935 0.4312217 0.4316543 0.4320633 0.4324319
5 0.5424061 0.5429081 0.5433806 0.5438652 0.5443152 0.5447376 0.5451372
6 0.5170712 0.5174810 0.5178837 0.5182883 0.5187080 0.5190997 0.5194434
        X1021       X1022       X1023       X1024       X1025       X1026       X1027
1 0.5615911 0.5624261 0.5632127 0.5639921 0.5647671 0.5655320 0.5662932
2 0.4909651 0.4916277 0.4922598 0.4928723 0.4934628 0.4940437 0.4946286
3 0.6235345 0.6242023 0.6248286 0.6254359 0.6260253 0.6266034 0.6271766
4 0.4327869 0.4334144 0.4340034 0.4345765 0.4351370 0.4356839 0.4362217
5 0.5454816 0.5460990 0.5466734 0.5472294 0.5477709 0.5482965 0.5488184
6 0.5198212 0.5202935 0.5207643 0.5212488 0.5217414 0.5222405 0.5227525
        X1028       X1029       X1030       X1031       X1032       X1033       X1034
1 0.5670560 0.5678128 0.5685554 0.5692857 0.5700039 0.5707109 0.5714004
2 0.4952176 0.4958038 0.4963782 0.4969439 0.4975030 0.4980627 0.4986200
3 0.6277524 0.6283270 0.6288890 0.6294406 0.6299839 0.6305205 0.6310482
4 0.4367592 0.4372883 0.4377999 0.4383072 0.4388110 0.4393058 0.4397884
5 0.5493460 0.5498708 0.5503833 0.5508867 0.5513828 0.5518753 0.5523614
6 0.5232786 0.5238075 0.5243213 0.5248185 0.5253107 0.5258005 0.5262780
        X1035       X1036       X1037       X1038       X1039       X1040       X1041
1 0.5720805 0.5727586 0.5734279 0.5740782 0.5747164 0.5753492 0.5759632
2 0.4991722 0.4997207 0.5002608 0.5007882 0.5013082 0.5018201 0.5023130
3 0.6315715 0.6320919 0.6326036 0.6330972 0.6335806 0.6340614 0.6345281
4 0.4402662 0.4407422 0.4412105 0.4416659 0.4421134 0.4425538 0.4429801
5 0.5528471 0.5533346 0.5538125 0.5542740 0.5547292 0.5551841 0.5556294
6 0.5267407 0.5271929 0.5276382 0.5280790 0.5285244 0.5289733 0.5294125
        X1042       X1043       X1044       X1045       X1046       X1047       X1048
1 0.5765528 0.5771315 0.5777037 0.5782616 0.5788006 0.5793257 0.5798412
2 0.5027848 0.5032468 0.5037063 0.5041574 0.5045918 0.5050139 0.5054330
```

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3 0.6349799 0.6354297 0.6358768 0.6363119 0.6367286 0.6371314 0.6375291
4 0.4433929 0.4437996 0.4442031 0.4445976 0.4449788 0.4453521 0.4457226
5 0.5560645 0.5564998 0.5569316 0.5573510 0.5577549 0.5581505 0.5585448
6 0.5298382 0.5302541 0.5306652 0.5310642 0.5314451 0.5318151 0.5321836
        X1049      X1050      X1051      X1052      X1053      X1054      X1055
1 0.5803432 0.5808218 0.5812764 0.5817145 0.5821373 0.5825462 0.5829387
2 0.5058450 0.5062386 0.5066151 0.5069814 0.5073373 0.5076817 0.5080132
3 0.6379194 0.6382928 0.6386492 0.6389953 0.6393304 0.6396529 0.6399581
4 0.4460865 0.4464369 0.4467746 0.4471018 0.4474159 0.4477198 0.4480153
5 0.5589340 0.5593072 0.5596630 0.5600060 0.5603354 0.5606565 0.5609701
6 0.5325473 0.5328982 0.5332344 0.5335612 0.5338839 0.5342049 0.5345234
        X1056      X1057      X1058      X1059      X1060      X1061      X1062
1 0.5833135 0.5836690 0.5840018 0.5843183 0.5846273 0.5849293 0.5852189
2 0.5083326 0.5086398 0.5089318 0.5092127 0.5094926 0.5097730 0.5100437
3 0.6402474 0.6405239 0.6407842 0.6410330 0.6412787 0.6415268 0.6417673
4 0.4483029 0.4485814 0.4488503 0.4491128 0.4493692 0.4496194 0.4498622
5 0.5612727 0.5615633 0.5618421 0.5621132 0.5623814 0.5626485 0.5629115
6 0.5348361 0.5351384 0.5354332 0.5357175 0.5359924 0.5362789 0.5365722
        X1063      X1064      X1065      X1066      X1067      X1068      X1069
1 0.5854957 0.5857602 0.5860042 0.5862340 0.5864552 0.5866625 0.5868528
2 0.5103031 0.5105494 0.5107795 0.5110030 0.5112241 0.5114365 0.5116363
3 0.6419926 0.6422047 0.6424038 0.6425982 0.6427848 0.6429552 0.6431128
4 0.4500992 0.4503295 0.4505505 0.4507675 0.4509786 0.4511797 0.4513728
5 0.5631707 0.5634169 0.5636408 0.5638550 0.5640641 0.5642618 0.5644441
6 0.5368479 0.5370997 0.5373329 0.5375541 0.5377620 0.5379522 0.5381348
        X1070      X1071      X1072      X1073      X1074      X1075      X1076
1 0.5870230 0.5871693 0.5872982 0.5874138 0.5875141 0.5876024 0.5876779
2 0.5118229 0.5119971 0.5121631 0.5123167 0.5124533 0.5125862 0.5127222
3 0.6432602 0.6433913 0.6435045 0.6436055 0.6436961 0.6437815 0.6438642
4 0.4515582 0.4517346 0.4519026 0.4520590 0.4522024 0.4523415 0.4524765
5 0.5646079 0.5647570 0.5649001 0.5650372 0.5651637 0.5652934 0.5654307
6 0.5383160 0.5384973 0.5386763 0.5388499 0.5390164 0.5391773 0.5393379
        X1077      X1078      X1079      X1080      X1081      X1082      X1083
1 0.5877368 0.5877863 0.5878218 0.5878402 0.5878398 0.5878137 0.5877720
2 0.5128523 0.5129773 0.5130963 0.5132073 0.5133046 0.5133789 0.5134378
3 0.6439402 0.6440120 0.6440724 0.6441183 0.6441481 0.6441507 0.6441363
4 0.4526040 0.4527308 0.4528535 0.4529602 0.4530466 0.4531115 0.4531616
5 0.5655570 0.5656695 0.5657739 0.5658716 0.5659567 0.5660165 0.5660601
6 0.5394997 0.5396584 0.5397979 0.5399098 0.5400075 0.5401082 0.5402049
        X1084      X1085      X1086      X1087      X1088      X1089      X1090
1 0.5877277 0.5876809 0.5876360 0.5875905 0.5875496 0.5875119 0.5874693
2 0.5134890 0.5135395 0.5136021 0.5136703 0.5137440 0.5138241 0.5139058
3 0.6441147 0.6440840 0.6440508 0.6440145 0.6439848 0.6439618 0.6439278
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4	0.4532018	0.4532348	0.4532747	0.4533201	0.4533727	0.4534311	0.4534851
5	0.5661001	0.5661366	0.5661818	0.5662342	0.5662892	0.5663444	0.5663966
6	0.5403005	0.5404020	0.5405097	0.5406164	0.5407101	0.5407921	0.5408795

	X1091	X1092	X1093	X1094	X1095	X1096	X1097
1	0.5874135	0.5873446	0.5872654	0.5871834	0.5870891	0.5869602	0.5867959
2	0.5139822	0.5140430	0.5140878	0.5141305	0.5141684	0.5141846	0.5141772
3	0.6438741	0.6438054	0.6437253	0.6436439	0.6435552	0.6434305	0.6432676
4	0.4535278	0.4535583	0.4535838	0.4536174	0.4536527	0.4536677	0.4536594
5	0.5664417	0.5664698	0.5664798	0.5664848	0.5664770	0.5664358	0.5663649
6	0.5409740	0.5410690	0.5411578	0.5412432	0.5413337	0.5414283	0.5415130

	X1098	X1099	X1100	X1101	X1102	X1103	X1104
1	0.5866227	0.5864484	0.5862550	0.5860403	0.5858129	0.5855502	0.5852452
2	0.5141668	0.5141557	0.5141257	0.5140703	0.5140016	0.5139142	0.5137971
3	0.6430960	0.6429203	0.6427219	0.6424959	0.6422565	0.6419945	0.6417032
4	0.4536472	0.4536292	0.4535903	0.4535318	0.4534621	0.4533665	0.4532399
5	0.5662834	0.5661925	0.5660811	0.5659512	0.5658155	0.5656600	0.5654756
6	0.5415838	0.5416399	0.5416819	0.5417185	0.5417476	0.5417670	0.5417768

	X1105	X1106	X1107	X1108	X1109	X1110	X1111
1	0.5849279	0.5845944	0.5842228	0.5838036	0.5833529	0.5828663	0.5823210
2	0.5136664	0.5135251	0.5133648	0.5131784	0.5129776	0.5127552	0.5124894
3	0.6414064	0.6411040	0.6407798	0.6404210	0.6400429	0.6396461	0.6392014
4	0.4530994	0.4529462	0.4527735	0.4525743	0.4523571	0.4521194	0.4518453
5	0.5652855	0.5650896	0.5648619	0.5645924	0.5643029	0.5639945	0.5636426
6	0.5417807	0.5417768	0.5417501	0.5416914	0.5416072	0.5414942	0.5413503

	X1112	X1113	X1114	X1115	X1116	X1117	X1118
1	0.5817099	0.5810326	0.5802778	0.5794448	0.5785437	0.5775766	0.5765351
2	0.5121769	0.5118150	0.5113926	0.5109149	0.5103922	0.5098204	0.5091889
3	0.6386991	0.6381448	0.6375289	0.6368490	0.6361195	0.6353443	0.6345105
4	0.4515298	0.4511714	0.4507656	0.4503172	0.4498342	0.4493192	0.4487615
5	0.5632377	0.5627846	0.5622789	0.5617216	0.5611184	0.5604709	0.5597710
6	0.5411824	0.5409793	0.5407323	0.5404575	0.5401575	0.5398154	0.5394187

	X1119	X1120	X1121	X1122	X1123	X1124	X1125
1	0.5754126	0.5742089	0.5729248	0.5715634	0.5701282	0.5686161	0.5670294
2	0.5084905	0.5077268	0.5069036	0.5060217	0.5050827	0.5040858	0.5030330
3	0.6336112	0.6326501	0.6316286	0.6305502	0.6294194	0.6282350	0.6270024
4	0.4481527	0.4474966	0.4467985	0.4460592	0.4452791	0.4444578	0.4435997
5	0.5590096	0.5581869	0.5573054	0.5563668	0.5553749	0.5543294	0.5532374
6	0.5389688	0.5384766	0.5379432	0.5373645	0.5367420	0.5360729	0.5353632

	X1126	X1127	X1128	X1129	X1130	X1131	X1132
1	0.5653754	0.5636567	0.5618710	0.5600200	0.5581146	0.5561627	0.5541596
2	0.5019310	0.5007826	0.4995805	0.4983242	0.4970235	0.4956845	0.4943009
3	0.6257313	0.6244222	0.6230698	0.6216737	0.6202417	0.6187752	0.6172674
4	0.4427089	0.4417837	0.4408210	0.4398213	0.4387923	0.4377374	0.4366470

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5 0.5521062 0.5509330 0.5497126 0.5484457 0.5471438 0.5458134 0.5444468
6 0.5346200 0.5338403 0.5330228 0.5321711 0.5312908 0.5303828 0.5294410
        X1133      X1134      X1135      X1136      X1137      X1138      X1139
1 0.5521066 0.5500134 0.5478850 0.5457287 0.5435489 0.5413448 0.5391222
2 0.4928736 0.4914168 0.4899370 0.4884381 0.4869201 0.4853796 0.4838224
3 0.6157222 0.6141530 0.6125660 0.6109642 0.6093474 0.6077156 0.6060791
4 0.4355247 0.4343847 0.4332289 0.4320580 0.4308730 0.4296729 0.4284631
5 0.5430439 0.5416196 0.5401780 0.5387214 0.5372532 0.5357709 0.5342798
6 0.5284644 0.5274573 0.5264272 0.5253779 0.5243092 0.5232231 0.5221197
        X1140      X1141      X1142      X1143      X1144      X1145      X1146
1 0.5368832 0.5346278 0.5323557 0.5300750 0.5278016 0.5255406 0.5232892
2 0.4822510 0.4806625 0.4790550 0.4774381 0.4758280 0.4742277 0.4726315
3 0.6044391 0.6027909 0.6011320 0.5994723 0.5978273 0.5961971 0.5945766
4 0.4272462 0.4260198 0.4247830 0.4235428 0.4223091 0.4210836 0.4198631
5 0.5327819 0.5312729 0.5297504 0.5282237 0.5267042 0.5251942 0.5236962
6 0.5210039 0.5198785 0.5187348 0.5175763 0.5164131 0.5152503 0.5140971
        X1147      X1148      X1149      X1150      X1151      X1152      X1153
1 0.5210509 0.5188327 0.5166356 0.5144639 0.5123249 0.5102198 0.5081491
2 0.4710404 0.4694592 0.4678905 0.4663397 0.4648117 0.4633065 0.4618229
3 0.5929691 0.5913816 0.5898171 0.5882765 0.5867584 0.5852657 0.5838018
4 0.4186510 0.4174531 0.4162701 0.4151026 0.4139509 0.4128141 0.4116944
5 0.5222149 0.5207540 0.5193131 0.5178966 0.5165075 0.5151421 0.5137997
6 0.5129652 0.5118581 0.5107702 0.5096928 0.5086188 0.5075479 0.5064908
        X1154      X1155      X1156      X1157      X1158      X1159      X1160
1 0.5061207 0.5041346 0.5021904 0.5002912 0.4984473 0.4966639 0.4949454
2 0.4603704 0.4589552 0.4575725 0.4562183 0.4548995 0.4536209 0.4523850
3 0.5823695 0.5809722 0.5796089 0.5782749 0.5769762 0.5757222 0.5745142
4 0.4105992 0.4095296 0.4084822 0.4074562 0.4064563 0.4054877 0.4045530
5 0.5124876 0.5112096 0.5099570 0.5087246 0.5075270 0.5063770 0.5052710
6 0.5054535 0.5044312 0.5034233 0.5024322 0.5014614 0.5005227 0.4996313
        X1161      X1162      X1163      X1164      X1165      X1166      X1167
1 0.4932916 0.4917012 0.4901880 0.4887616 0.4874165 0.4861487 0.4849454
2 0.4511911 0.4500418 0.4489498 0.4479234 0.4469627 0.4460610 0.4452018
3 0.5733479 0.5722242 0.5711574 0.5701556 0.5692175 0.5683369 0.5675015
4 0.4036541 0.4027952 0.4019843 0.4012271 0.4005255 0.3998747 0.3992573
5 0.5042028 0.5031776 0.5022120 0.5013103 0.5004667 0.4996760 0.4989188
6 0.4987939 0.4980017 0.4972487 0.4965461 0.4958818 0.4952464 0.4946437
        X1168      X1169      X1170      X1171      X1172      X1173      X1174
1 0.4838018 0.4827144 0.4816901 0.4807371 0.4798565 0.4790432 0.4782946
2 0.4443853 0.4436079 0.4428700 0.4421778 0.4415345 0.4409461 0.4404150
3 0.5667087 0.5659478 0.5652221 0.5645522 0.5639420 0.5633821 0.5628707
4 0.3986712 0.3981118 0.3975818 0.3970909 0.3966405 0.3962310 0.3958627
5 0.4981906 0.4974927 0.4968309 0.4962138 0.4956413 0.4951138 0.4946330
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6 0.4940790 0.4935632 0.4930982 0.4926672 0.4922652 0.4918983 0.4915717
        X1175     X1176     X1177     X1178     X1179     X1180     X1181
1 0.4776053 0.4769776 0.4764210 0.4759435 0.4755276 0.4751607 0.4748468
2 0.4399290 0.4394858 0.4390922 0.4387554 0.4384634 0.4382076 0.4379967
3 0.5624027 0.5619772 0.5616051 0.5612949 0.5610314 0.5608062 0.5606254
4 0.3955247 0.3952146 0.3949392 0.3947015 0.3944909 0.3943054 0.3941516
5 0.4941944 0.4938038 0.4934664 0.4931803 0.4929358 0.4927321 0.4925737
6 0.4912791 0.4910087 0.4907639 0.4905626 0.4904057 0.4902899 0.4902130
        X1182     X1183     X1184     X1185     X1186     X1187     X1188
1 0.4745689 0.4743200 0.4741235 0.4739817 0.4738586 0.4737507 0.4736740
2 0.4378261 0.4376874 0.4375811 0.4375098 0.4374589 0.4374256 0.4374135
3 0.5604764 0.5603495 0.5602528 0.5601893 0.5601364 0.5600921 0.5600674
4 0.3940170 0.3938948 0.3937983 0.3937308 0.3936775 0.3936372 0.3936145
5 0.4924436 0.4923301 0.4922438 0.4921883 0.4921366 0.4920864 0.4920616
6 0.4901599 0.4901276 0.4901156 0.4901193 0.4901308 0.4901490 0.4901865
        X1189     X1190     X1191     X1192     X1193     X1194     X1195
1 0.4736273 0.4735869 0.4735518 0.4735323 0.4735236 0.4735230 0.4735370
2 0.4374208 0.4374288 0.4374365 0.4374549 0.4374802 0.4375138 0.4375615
3 0.5600615 0.5600524 0.5600394 0.5600421 0.5600566 0.5600752 0.5601030
4 0.3936081 0.3936044 0.3936041 0.3936189 0.3936473 0.3936868 0.3937387
5 0.4920625 0.4920621 0.4920587 0.4920690 0.4920917 0.4921178 0.4921487
6 0.4902449 0.4903034 0.4903565 0.4904125 0.4904735 0.4905451 0.4906344
        X1196     X1197     X1198     X1199     X1200     X1201     X1202
1 0.4735670 0.4736131 0.4736734 0.4737505 0.4738463 0.4739516 0.4740659
2 0.4376162 0.4376754 0.4377444 0.4378276 0.4379250 0.4380293 0.4381404
3 0.5601389 0.5601814 0.5602342 0.5603025 0.5603889 0.5604845 0.5605878
4 0.3938003 0.3938713 0.3939498 0.3940374 0.3941374 0.3942462 0.3943631
5 0.4921854 0.4922301 0.4922835 0.4923491 0.4924301 0.4925180 0.4926125
6 0.4907293 0.4908196 0.4909169 0.4910322 0.4911623 0.4912973 0.4914380
        X1203     X1204     X1205     X1206     X1207     X1208     X1209
1 0.4741985 0.4743517 0.4745310 0.4747347 0.4749506 0.4751780 0.4754299
2 0.4382634 0.4384001 0.4385577 0.4387339 0.4389152 0.4391018 0.4393113
3 0.5607086 0.5608487 0.5610141 0.5612019 0.5613952 0.5615925 0.5618073
4 0.3944920 0.3946335 0.3947945 0.3949739 0.3951600 0.3953516 0.3955568
5 0.4927210 0.4928445 0.4929899 0.4931556 0.4933307 0.4935149 0.4937178
6 0.4915903 0.4917569 0.4919414 0.4921402 0.4923516 0.4925757 0.4928039
        X1210     X1211     X1212     X1213     X1214     X1215     X1216
1 0.4757076 0.4760013 0.4763082 0.4766317 0.4769711 0.4773262 0.4776993
2 0.4395448 0.4397901 0.4400446 0.4403139 0.4405972 0.4408882 0.4411883
3 0.5620412 0.5622858 0.5625391 0.5628051 0.5630827 0.5633693 0.5636677
4 0.3957766 0.3960057 0.3962431 0.3964956 0.3967629 0.3970404 0.3973295
5 0.4939405 0.4941739 0.4944161 0.4946733 0.4949458 0.4952282 0.4955226
6 0.4930342 0.4932700 0.4935131 0.4937701 0.4940405 0.4943219 0.4946152
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         X1217      X1218      X1219      X1220      X1221      X1222      X1223
1 0.4780881 0.4784888 0.4789036 0.4793346 0.4797826 0.4802493 0.4807310
2 0.4414997 0.4418214 0.4421531 0.4424947 0.4428482 0.4432146 0.4435921
3 0.5639822 0.5643114 0.5646522 0.5650043 0.5653714 0.5657570 0.5661550
4 0.3976302 0.3979393 0.3982558 0.3985810 0.3989186 0.3992717 0.3996360
5 0.4958295 0.4961444 0.4964675 0.4968014 0.4971512 0.4975224 0.4979089
6 0.4949208 0.4952362 0.4955606 0.4958952 0.4962413 0.4965977 0.4969624
         X1224      X1225      X1226      X1227      X1228      X1229      X1230
1 0.4812211 0.4817170 0.4822158 0.4827161 0.4832171 0.4837184 0.4842360
2 0.4439779 0.4443692 0.4447663 0.4451680 0.4455695 0.4459708 0.4463854
3 0.5665562 0.5669604 0.5673715 0.5677867 0.5681980 0.5686046 0.5690214
4 0.4000052 0.4003780 0.4007535 0.4011302 0.4015060 0.4018805 0.4022636
5 0.4983017 0.4986989 0.4990978 0.4994970 0.4998941 0.5002881 0.5006898
6 0.4973341 0.4977126 0.4980992 0.4984903 0.4988838 0.4992777 0.4996671
         X1231      X1232      X1233      X1234      X1235      X1236      X1237
1 0.4847672 0.4853047 0.4858452 0.4863798 0.4869054 0.4874332 0.4879633
2 0.4468110 0.4472410 0.4476731 0.4481014 0.4485239 0.4489478 0.4493732
3 0.5694474 0.5698812 0.5703203 0.5707574 0.5711902 0.5716251 0.5720622
4 0.4026545 0.4030503 0.4034492 0.4038450 0.4042360 0.4046301 0.4050276
5 0.5010988 0.5015143 0.5019344 0.5023482 0.5027538 0.5031614 0.5035719
6 0.5000541 0.5004521 0.5008597 0.5012677 0.5016748 0.5020842 0.5024957
         X1238      X1239      X1240      X1241      X1242      X1243      X1244
1 0.4884964 0.4890308 0.4895614 0.4900841 0.4905977 0.4911011 0.4915923
2 0.4497992 0.4502250 0.4506506 0.4510745 0.4514903 0.4518943 0.4522879
3 0.5725020 0.5729438 0.5733822 0.5738132 0.5742321 0.5746362 0.5750290
4 0.4054316 0.4058421 0.4062503 0.4066511 0.4070437 0.4074271 0.4078041
5 0.5039864 0.5044050 0.5048197 0.5052254 0.5056212 0.5060063 0.5063824
6 0.5029108 0.5033301 0.5037472 0.5041586 0.5045635 0.5049610 0.5053525
         X1245      X1246      X1247      X1248      X1249      X1250      X1251
1 0.4920692 0.4925349 0.4929929 0.4934412 0.4938773 0.4942996 0.4947068
2 0.4526723 0.4530502 0.4534242 0.4537921 0.4541505 0.4544992 0.4548396
3 0.5754132 0.5757917 0.5761681 0.5765401 0.5769035 0.5772570 0.5775994
4 0.4081766 0.4085452 0.4089111 0.4092723 0.4096260 0.4099720 0.4103108
5 0.5067503 0.5071116 0.5074684 0.5078203 0.5081666 0.5085068 0.5088401
6 0.5057389 0.5061196 0.5064930 0.5068580 0.5072143 0.5075622 0.5079033
         X1252      X1253      X1254      X1255      X1256      X1257      X1258
1 0.4950978 0.4954734 0.4958332 0.4961803 0.4965129 0.4968262 0.4971190
2 0.4551702 0.4554888 0.4557959 0.4560972 0.4563908 0.4566711 0.4569366
3 0.5779304 0.5782523 0.5785646 0.5788696 0.5791653 0.5794456 0.5797092
4 0.4106421 0.4109677 0.4112870 0.4116000 0.4119048 0.4121958 0.4124720
5 0.5091658 0.5094844 0.5097964 0.5101059 0.5104103 0.5106991 0.5109712
6 0.5082372 0.5085658 0.5088884 0.5092040 0.5095116 0.5098119 0.5101051
         X1259      X1260      X1261      X1262      X1263      X1264      X1265
```

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1 0.4973921 0.4976443 0.4978704 0.4980688 0.4982524 0.4984214 0.4985680
2 0.4571848 0.4574148 0.4576305 0.4578311 0.4580169 0.4581869 0.4583417
3 0.5799553 0.5801831 0.5803909 0.5805772 0.5807468 0.5808996 0.5810392
4 0.4127365 0.4129887 0.4132255 0.4134457 0.4136521 0.4138444 0.4140258
5 0.5112314 0.5114792 0.5117096 0.5119213 0.5121200 0.5123055 0.5124788
6 0.5103857 0.5106520 0.5109045 0.5111432 0.5113695 0.5115835 0.5117863
        X1266       X1267       X1268       X1269       X1270       X1271       X1272
1 0.4986897 0.4987872 0.4988607 0.4989126 0.4989423 0.4989442 0.4989137
2 0.4584817 0.4586066 0.4587156 0.4588096 0.4588872 0.4589431 0.4589731
3 0.5811666 0.5812798 0.5813778 0.5814598 0.5815236 0.5815610 0.5815659
4 0.4141973 0.4143564 0.4145021 0.4146365 0.4147596 0.4148659 0.4149515
5 0.5126396 0.5127882 0.5129247 0.5130495 0.5131615 0.5132549 0.5133250
6 0.5119768 0.5121613 0.5123419 0.5125072 0.5126510 0.5127837 0.5129116
        X1273       X1274       X1275       X1276       X1277       X1278       X1279
1 0.4988540 0.4987703 0.4986596 0.4985178 0.4983455 0.4981417 0.4979054
2 0.4589816 0.4589744 0.4589496 0.4589043 0.4588377 0.4587480 0.4586365
3 0.5815442 0.5815045 0.5814462 0.5813674 0.5812676 0.5811451 0.5809999
4 0.4150182 0.4150687 0.4151026 0.4151206 0.4151233 0.4151100 0.4150811
5 0.5133749 0.5134083 0.5134246 0.5134243 0.5134067 0.5133683 0.5133089
6 0.5130318 0.5131416 0.5132412 0.5133287 0.5134024 0.5134622 0.5135066
        X1280       X1281       X1282       X1283       X1284       X1285       X1286
1 0.4976343 0.4973282 0.4969960 0.4966349 0.4962302 0.4957832 0.4952970
2 0.4585050 0.4583512 0.4581766 0.4579786 0.4577469 0.4574845 0.4571977
3 0.5808312 0.5806355 0.5804148 0.5801687 0.5798848 0.5795643 0.5792104
4 0.4150367 0.4149743 0.4148943 0.4147953 0.4146696 0.4145193 0.4143443
5 0.5132269 0.5131212 0.5129982 0.5128577 0.5126916 0.5125003 0.5122801
6 0.5135331 0.5135386 0.5135185 0.5134760 0.5134188 0.5133435 0.5132334
        X1287       X1288       X1289       X1290       X1291       X1292       X1293
1 0.4947702 0.4942014 0.4935947 0.4929474 0.4922583 0.4915286 0.4907605
2 0.4568841 0.4565425 0.4561756 0.4557741 0.4553363 0.4548683 0.4543722
3 0.5788210 0.5783941 0.5779335 0.5774413 0.5769166 0.5763541 0.5757548
4 0.4141429 0.4139176 0.4136711 0.4133999 0.4131034 0.4127798 0.4124289
5 0.5120297 0.5117487 0.5114400 0.5111068 0.5107483 0.5103609 0.5099451
6 0.5130910 0.5129280 0.5127442 0.5125451 0.5123338 0.5121034 0.5118524
        X1294       X1295       X1296       X1297       X1298       X1299       X1300
1 0.4899473 0.4890927 0.4881982 0.4872625 0.4862696 0.4852205 0.4841185
2 0.4538399 0.4532750 0.4526840 0.4520651 0.4514010 0.4506918 0.4499405
3 0.5751188 0.5744500 0.5737578 0.5730408 0.5722722 0.5714504 0.5705782
4 0.4120507 0.4116483 0.4112265 0.4107835 0.4103063 0.4097959 0.4092577
5 0.5094966 0.5090181 0.5085133 0.5079797 0.5074034 0.5067865 0.5061286
6 0.5115869 0.5113081 0.5110079 0.5106834 0.5103277 0.5099435 0.5095251
        X1301       X1302       X1303       X1304       X1305       X1306       X1307
1 0.4829656 0.4817544 0.4804844 0.4791599 0.4777902 0.4763679 0.4748886
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2 0.4491492 0.4483189 0.4474535 0.4465472 0.4455989 0.4446075 0.4435716
3 0.5696566 0.5686848 0.5676642 0.5665963 0.5654879 0.5643354 0.5631363
4 0.4086935 0.4080983 0.4074708 0.4068107 0.4061224 0.4054008 0.4046444
5 0.5054296 0.5046872 0.5039000 0.5030687 0.5021984 0.5012887 0.5003435
6 0.5090696 0.5085800 0.5080609 0.5075103 0.5069300 0.5063232 0.5056915
        X1308     X1309     X1310     X1311     X1312     X1313     X1314
1 0.4733482 0.4717413 0.4700921 0.4684186 0.4667181 0.4649777 0.4631916
2 0.4424807 0.4413254 0.4401293 0.4389110 0.4376743 0.4364273 0.4351636
3 0.5618778 0.5605496 0.5591738 0.5577632 0.5563221 0.5548569 0.5533696
4 0.4038503 0.4030132 0.4021442 0.4012484 0.4003285 0.3993890 0.3984299
5 0.4993512 0.4982967 0.4972022 0.4960887 0.4949579 0.4938096 0.4926387
6 0.5050365 0.5043504 0.5036131 0.5028035 0.5019454 0.5010859 0.5002089
        X1315     X1316     X1317     X1318     X1319     X1320     X1321
1 0.4613295 0.4593950 0.4574071 0.4553581 0.4532090 0.4510000 0.4490142
2 0.4338440 0.4324696 0.4310558 0.4295981 0.4280601 0.4264923 0.4251965
3 0.5518442 0.5502726 0.5486124 0.5468654 0.5450406 0.5432009 0.5416932
4 0.3974406 0.3964188 0.3953473 0.3942267 0.3930637 0.3918774 0.3908155
5 0.4914139 0.4901291 0.4887642 0.4873164 0.4858061 0.4842746 0.4829856
6 0.4992627 0.4982637 0.4973103 0.4963963 0.4954265 0.4944286 0.4935910
        X1322     X1323     X1324     X1325     X1326     X1327     X1328
1 0.4472391 0.4455524 0.4439569 0.4423727 0.4407843 0.4387932 0.4363991
2 0.4241498 0.4231281 0.4221357 0.4211693 0.4202104 0.4188135 0.4169814
3 0.5404881 0.5393085 0.5381589 0.5369747 0.5357452 0.5341541 0.5322031
4 0.3898979 0.3891910 0.3886705 0.3880954 0.3874571 0.3863796 0.3848649
5 0.4819297 0.4809808 0.4801447 0.4794314 0.4788099 0.4777640 0.4762979
6 0.4929010 0.4921819 0.4914420 0.4908023 0.4902485 0.4896903 0.4891327
        X1329     X1330     X1331     X1332     X1333     X1334     X1335
1 0.4339411 0.4314432 0.4289971 0.4265856 0.4245868 0.4230122 0.4216184
2 0.4150549 0.4130508 0.4113195 0.4098455 0.4085247 0.4073432 0.4061592
3 0.5300525 0.5277281 0.5254685 0.5232678 0.5212911 0.5195498 0.5177021
4 0.3832955 0.3816924 0.3802246 0.3788778 0.3775901 0.3763696 0.3752679
5 0.4745510 0.4725454 0.4707333 0.4691134 0.4677644 0.4666725 0.4654683
6 0.4885289 0.4878738 0.4872103 0.4865465 0.4856887 0.4846213 0.4836136
        X1336     X1337     X1338     X1339     X1340     X1341     X1342
1 0.4203484 0.4190100 0.4175615 0.4160882 0.4146157 0.4132104 0.4119001
2 0.4049477 0.4037199 0.4024675 0.4013013 0.4002553 0.3991410 0.3978851
3 0.5156877 0.5138084 0.5121253 0.5105603 0.5090822 0.5076428 0.5062268
4 0.3742771 0.3733610 0.3725000 0.3717071 0.3709848 0.3702717 0.3695438
5 0.4640917 0.4628739 0.4618772 0.4609924 0.4601831 0.4592598 0.4581476
6 0.4827118 0.4817659 0.4807350 0.4797586 0.4788895 0.4781549 0.4775614
        X1343     X1344     X1345     X1346     X1347     X1348     X1349
1 0.4106851 0.4095660 0.4085740 0.4077084 0.4067685 0.4056132 0.4043551
2 0.3965684 0.3952376 0.3940427 0.3930629 0.3921145 0.3910613 0.3899988
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3 0.5048610 0.5035479 0.5022325 0.5008841 0.4994836 0.4980144 0.4965845
4 0.3688657 0.3682642 0.3676247 0.3668741 0.3660261 0.3651021 0.3641439
5 0.4568662 0.4554234 0.4540377 0.4528469 0.4517422 0.4506473 0.4495567
6 0.4769920 0.4763552 0.4756011 0.4747335 0.4737811 0.4727568 0.4716995
        X1350      X1450      X1451      X1452      X1453      X1454      X1455
1 0.4030847 0.09914374 0.0990665 0.09904843 0.09901116 0.09896992 0.09899732
2 0.3890042 0.11889982 0.1188293 0.11886118 0.11885938 0.11883965 0.11884022
3 0.4952719 0.16541625 0.1653840 0.16544224 0.16544069 0.16539999 0.16541587
4 0.3631726 0.18900615 0.1888844 0.18883592 0.18875834 0.18866144 0.18861220
5 0.4484483 0.17553672 0.1754396 0.17541573 0.17536678 0.17530777 0.17533887
6 0.4706512 0.28060780 0.2804020 0.28030224 0.28023111 0.28019523 0.28020425
         X1456      X1457      X1458      X1459      X1460      X1461      X1462
1 0.09910137 0.09919901 0.09929203 0.09940126 0.09953377 0.09969176 0.0998788
2 0.11886826 0.11892310 0.11901102 0.11911473 0.11923622 0.11937594 0.1195375
3 0.16549909 0.16562158 0.16578820 0.16598713 0.16622207 0.16648100 0.1667673
4 0.18861623 0.18864596 0.18870309 0.18877395 0.18885972 0.18896251 0.1890851
5 0.17546824 0.17559432 0.17571824 0.17584697 0.17598563 0.17615028 0.1763476
6 0.28026344 0.28036575 0.28051727 0.28064610 0.28075003 0.28091305 0.2811508
        X1463      X1464      X1465      X1466      X1467      X1468      X1469
1 0.1000781 0.1002891 0.1005139 0.1007545 0.1010259 0.1013346 0.1016695
2 0.1197184 0.1199209 0.1201498 0.1204080 0.1206831 0.1209714 0.1212933
3 0.1670680 0.1673841 0.1677332 0.1681214 0.1685508 0.1690232 0.1695242
4 0.1892184 0.1893623 0.1895159 0.1896797 0.1898674 0.1900843 0.1903238
5 0.1765718 0.1768248 0.1771136 0.1774410 0.1778008 0.1781919 0.1786093
6 0.2813654 0.2815417 0.2817220 0.2819188 0.2821355 0.2823737 0.2826352
        X1470      X1471      X1472      X1473      X1474      X1475      X1476
1 0.1020261 0.1024135 0.1028366 0.1032932 0.1037814 0.1043021 0.1048563
2 0.1216578 0.1220678 0.1225254 0.1230120 0.1235150 0.1240371 0.1245809
3 0.1700480 0.1706161 0.1712393 0.1719171 0.1726496 0.1734178 0.1742093
4 0.1905831 0.1908592 0.1911500 0.1914619 0.1917986 0.1921560 0.1925313
5 0.1790510 0.1795276 0.1800439 0.1806025 0.1812057 0.1818401 0.1824966
6 0.2829217 0.2832308 0.2835605 0.2839228 0.2843258 0.2847585 0.2852125
        X1477      X1478      X1479      X1480      X1481      X1482      X1483
1 0.1054372 0.1060382 0.1066615 0.1073101 0.1079830 0.1086786 0.1093970
2 0.1251523 0.1257555 0.1263791 0.1270126 0.1276656 0.1283473 0.1290530
3 0.1750323 0.1758925 0.1767890 0.1777213 0.1786882 0.1796883 0.1807106
4 0.1929188 0.1933136 0.1937185 0.1941368 0.1945767 0.1950463 0.1955341
5 0.1831813 0.1838975 0.1846406 0.1854074 0.1861946 0.1869998 0.1878246
6 0.2856788 0.2861507 0.2866404 0.2871586 0.2877002 0.2882613 0.2888496
        X1484      X1485      X1486      X1487      X1488      X1489      X1490
1 0.1101391 0.1109039 0.1116907 0.1124924 0.1132998 0.1141180 0.1149545
2 0.1297785 0.1305230 0.1312843 0.1320616 0.1328541 0.1336583 0.1344692
3 0.1817437 0.1827952 0.1838752 0.1849766 0.1860899 0.1872199 0.1883736
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4 0.1960268 0.1965312 0.1970569 0.1975986 0.1981485 0.1987067 0.1992736
5 0.1886702 0.1895380 0.1904303 0.1913427 0.1922699 0.1932108 0.1941635
6 0.2894717 0.2901105 0.2907456 0.2913834 0.2920353 0.2927049 0.2933941
          X1491      X1492      X1493      X1494      X1495      X1496      X1497
1 0.1158056 0.1166651 0.1175366 0.1184280 0.1193330 0.1202385 0.1211463
2 0.1352902 0.1361267 0.1369764 0.1378365 0.1387049 0.1395773 0.1404545
3 0.1895454 0.1907253 0.1919147 0.1931187 0.1943357 0.1955639 0.1968027
4 0.1998498 0.2004350 0.2010280 0.2016298 0.2022391 0.2028517 0.2034676
5 0.1951268 0.1960982 0.1970780 0.1980705 0.1990759 0.2000922 0.2011159
6 0.2940969 0.2948037 0.2955118 0.2962228 0.2969402 0.2976674 0.2984030
          X1498      X1499      X1500      X1501      X1502      X1503      X1504
1 0.1220629 0.1229875 0.1239216 0.1248647 0.1258109 0.1267576 0.1277083
2 0.1413423 0.1422402 0.1431467 0.1440612 0.1449817 0.1459055 0.1468295
3 0.1980551 0.1993184 0.2005864 0.2018608 0.2031530 0.2044577 0.2057596
4 0.2040866 0.2047088 0.2053349 0.2059655 0.2066036 0.2072456 0.2078874
5 0.2021450 0.2031792 0.2042188 0.2052644 0.2063215 0.2073866 0.2084545
6 0.2991417 0.2998815 0.3006212 0.3013619 0.3021107 0.3028647 0.3036188
          X1505      X1506      X1507      X1508      X1509      X1510      X1511
1 0.1286629 0.1296251 0.1305959 0.1315777 0.1325701 0.1335629 0.1345554
2 0.1477549 0.1486944 0.1496472 0.1506000 0.1515526 0.1525119 0.1534773
3 0.2070586 0.2083624 0.2096702 0.2109813 0.2122953 0.2136178 0.2149484
4 0.2085305 0.2091798 0.2098347 0.2104859 0.2111325 0.2117858 0.2124472
5 0.2095254 0.2105989 0.2116747 0.2127557 0.2138427 0.2149373 0.2160386
6 0.3043749 0.3051433 0.3059233 0.3067103 0.3075042 0.3083075 0.3091199
          X1512      X1513      X1514      X1515      X1516      X1517      X1518
1 0.1355604 0.1365766 0.1375961 0.1386177 0.1396335 0.1406425 0.1416608
2 0.1544513 0.1554328 0.1564188 0.1574076 0.1583950 0.1593809 0.1603668
3 0.2162831 0.2176222 0.2189648 0.2203071 0.2216509 0.2229950 0.2243450
4 0.2131170 0.2137949 0.2144763 0.2151598 0.2158482 0.2165403 0.2172346
5 0.2171470 0.2182615 0.2193794 0.2204968 0.2216116 0.2227250 0.2238441
6 0.3099426 0.3107776 0.3116153 0.3124538 0.3132950 0.3141364 0.3149718
          X1519      X1520      X1521      X1522      X1523      X1524      X1525
1 0.1426885 0.1437186 0.1447492 0.1457877 0.1468322 0.1478773 0.1489217
2 0.1613503 0.1623332 0.1633158 0.1643048 0.1652983 0.1662962 0.1672972
3 0.2257036 0.2270605 0.2284113 0.2297642 0.2311189 0.2324777 0.2338351
4 0.2179321 0.2186306 0.2193301 0.2200303 0.2207281 0.2214261 0.2221224
5 0.2249676 0.2260890 0.2272069 0.2283269 0.2294472 0.2305674 0.2316849
6 0.3158028 0.3166338 0.3174592 0.3182819 0.3191047 0.3199404 0.3207863
          X1526      X1527      X1528      X1529      X1530      X1531      X1532
1 0.1499684 0.1510158 0.1520623 0.1531058 0.1541501 0.1551947 0.1562383
2 0.1682997 0.1693015 0.1703003 0.1712961 0.1722912 0.1732835 0.1742737
3 0.2351921 0.2365475 0.2378966 0.2392393 0.2405776 0.2419084 0.2432344
4 0.2228208 0.2235224 0.2242240 0.2249259 0.2256271 0.2263241 0.2270179
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5 0.2328015 0.2339166 0.2350304 0.2361406 0.2372447 0.2383407 0.2394306
6 0.3216282 0.3224649 0.3233025 0.3241421 0.3249796 0.3258101 0.3266335
         X1533     X1534     X1535     X1536     X1537     X1538     X1539
1 0.1572788 0.1583166 0.1593511 0.1603815 0.1614077 0.1624296 0.1634437
2 0.1752585 0.1762351 0.1772030 0.1781649 0.1791217 0.1800706 0.1810075
3 0.2445545 0.2458704 0.2471821 0.2484892 0.2497886 0.2510763 0.2523502
4 0.2277081 0.2283970 0.2290849 0.2297709 0.2304535 0.2311298 0.2317985
5 0.2405130 0.2415912 0.2426637 0.2437285 0.2447864 0.2458358 0.2468744
6 0.3274492 0.3282576 0.3290578 0.3298585 0.3306601 0.3314549 0.3322429
         X1540     X1541     X1542     X1543     X1544     X1545     X1546
1 0.1644522 0.1654569 0.1664581 0.1674549 0.1684480 0.1694387 0.1704278
2 0.1819366 0.1828641 0.1837940 0.1847205 0.1856378 0.1865484 0.1874560
3 0.2536166 0.2548794 0.2561387 0.2573913 0.2586354 0.2598730 0.2611051
4 0.2324627 0.2331249 0.2337867 0.2344456 0.2350988 0.2357481 0.2363960
5 0.2479055 0.2489315 0.2499557 0.2509749 0.2519853 0.2529895 0.2539890
6 0.3330308 0.3338186 0.3346046 0.3353880 0.3361711 0.3369541 0.3377346
         X1547     X1548     X1549     X1550     X1551     X1552     X1553
1 0.1714133 0.1723949 0.1733724 0.1743452 0.1753122 0.1762742 0.1772305
2 0.1883591 0.1892571 0.1901497 0.1910359 0.1919164 0.1927944 0.1936684
3 0.2623276 0.2635427 0.2647528 0.2659547 0.2671481 0.2683350 0.2695139
4 0.2370397 0.2376794 0.2383172 0.2389509 0.2395816 0.2402130 0.2408432
5 0.2549808 0.2559667 0.2569478 0.2579200 0.2588810 0.2598338 0.2607793
6 0.3385125 0.3392894 0.3400645 0.3408345 0.3415973 0.3423530 0.3430989
         X1554     X1555     X1556     X1557     X1558     X1559     X1560
1 0.1781790 0.1791230 0.1800650 0.1810039 0.1819366 0.1828607 0.1837768
2 0.1945341 0.1953918 0.1962452 0.1970938 0.1979359 0.1987711 0.1995992
3 0.2706835 0.2718445 0.2729997 0.2741484 0.2752871 0.2764148 0.2775320
4 0.2414694 0.2420915 0.2427105 0.2433285 0.2439469 0.2445639 0.2451765
5 0.2617177 0.2626502 0.2635792 0.2645046 0.2654226 0.2663314 0.2672315
6 0.3438354 0.3445696 0.3453032 0.3460327 0.3467586 0.3474818 0.3482006
         X1561     X1562     X1563     X1564     X1565     X1566     X1567
1 0.1846866 0.1855902 0.1864865 0.1873754 0.1882567 0.1891308 0.1899982
2 0.2004237 0.2012456 0.2020609 0.2028692 0.2036728 0.2044718 0.2052645
3 0.2786403 0.2797412 0.2808344 0.2819201 0.2829990 0.2840706 0.2851336
4 0.2457847 0.2463886 0.2469891 0.2475871 0.2481811 0.2487717 0.2493571
5 0.2681262 0.2690182 0.2699061 0.2707878 0.2716624 0.2725293 0.2733871
6 0.3489144 0.3496256 0.3503347 0.3510367 0.3517316 0.3524218 0.3531067
         X1568     X1569     X1570     X1571     X1572     X1573     X1574
1 0.1908606 0.1917209 0.1925780 0.1934307 0.1942789 0.1951213 0.1959574
2 0.2060501 0.2068304 0.2076067 0.2083797 0.2091479 0.2099101 0.2106678
3 0.2861871 0.2872312 0.2882654 0.2892927 0.2903142 0.2913291 0.2923381
4 0.2499366 0.2505158 0.2510957 0.2516735 0.2522484 0.2528204 0.2533913
5 0.2742362 0.2750792 0.2759164 0.2767491 0.2775762 0.2783973 0.2792155
```

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6 0.3537882 0.3544728 0.3551587 0.3558403 0.3565163 0.3571858 0.3578528
        X1575      X1576      X1577      X1578      X1579      X1580      X1581
1 0.1967871 0.1976106 0.1984310 0.1992476 0.2000578 0.2008626 0.2016659
2 0.2114190 0.2121635 0.2129051 0.2136444 0.2143785 0.2151069 0.2158308
3 0.2933377 0.2943274 0.2953138 0.2962970 0.2972721 0.2982396 0.2992030
4 0.2539610 0.2545288 0.2550995 0.2556732 0.2562420 0.2568050 0.2573675
5 0.2800318 0.2808426 0.2816469 0.2824472 0.2832459 0.2840411 0.2848335
6 0.3585234 0.3591950 0.3598651 0.3605324 0.3611958 0.3618555 0.3625096
        X1582      X1583      X1584      X1585      X1586      X1587      X1588
1 0.2024656 0.2032576 0.2040435 0.2048257 0.2056030 0.2063752 0.2071423
2 0.2165492 0.2172624 0.2179728 0.2186831 0.2193903 0.2200914 0.2207857
3 0.3001604 0.3011098 0.3020537 0.3029938 0.3039276 0.3048523 0.3057688
4 0.2579294 0.2584902 0.2590527 0.2596177 0.2601830 0.2607498 0.2613172
5 0.2856227 0.2864088 0.2871936 0.2879775 0.2887588 0.2895370 0.2903110
6 0.3631589 0.3638065 0.3644529 0.3650974 0.3657378 0.3663723 0.3670021
        X1589      X1590      X1591      X1592      X1593      X1594      X1595
1 0.2079003 0.2086484 0.2093886 0.2101201 0.2108459 0.2115677 0.2122850
2 0.2214708 0.2221475 0.2228202 0.2234872 0.2241484 0.2248043 0.2254523
3 0.3066774 0.3075775 0.3084685 0.3093494 0.3102231 0.3110896 0.3119476
4 0.2618791 0.2624357 0.2629905 0.2635424 0.2640928 0.2646416 0.2651882
5 0.2910774 0.2918363 0.2925903 0.2933391 0.2940840 0.2948243 0.2955579
6 0.3676267 0.3682450 0.3688599 0.3694728 0.3700844 0.3706933 0.3712994
        X1596      X1597      X1598      X1599      X1600      X1601      X1602
1 0.2129977 0.2137067 0.2144108 0.2151092 0.2158007 0.2164833 0.2171572
2 0.2260927 0.2267270 0.2273545 0.2279778 0.2285977 0.2292158 0.2298299
3 0.3127989 0.3136452 0.3144856 0.3153212 0.3161501 0.3169718 0.3177867
4 0.2657335 0.2662769 0.2668182 0.2673600 0.2679012 0.2684396 0.2689728
5 0.2962879 0.2970188 0.2977472 0.2984704 0.2991876 0.2998970 0.3005988
6 0.3719019 0.3724957 0.3730821 0.3736668 0.3742470 0.3748220 0.3753950
        X1603      X1604      X1605      X1606      X1607      X1608      X1609
1 0.2178256 0.2184878 0.2191420 0.2197881 0.2204251 0.2210519 0.2216697
2 0.2304363 0.2310361 0.2316330 0.2322243 0.2328070 0.2333805 0.2339459
3 0.3185943 0.3193919 0.3201769 0.3209511 0.3217176 0.3224755 0.3232273
4 0.2694995 0.2700216 0.2705395 0.2710538 0.2715661 0.2720747 0.2725799
5 0.3012958 0.3019874 0.3026713 0.3033473 0.3040188 0.3046833 0.3053390
6 0.3759692 0.3765420 0.3771075 0.3776655 0.3782154 0.3787584 0.3792952
        X1610      X1611      X1612      X1613      X1614      X1615      X1616
1 0.2222792 0.2228822 0.2234763 0.2240594 0.2246320 0.2251942 0.2257463
2 0.2345025 0.2350490 0.2355857 0.2361124 0.2366278 0.2371324 0.2376272
3 0.3239705 0.3246973 0.3254082 0.3261077 0.3267927 0.3274614 0.3281157
4 0.2730802 0.2735707 0.2740541 0.2745348 0.2750095 0.2754783 0.2759443
5 0.3059864 0.3066217 0.3072446 0.3078602 0.3084655 0.3090541 0.3096311
6 0.3798237 0.3803504 0.3808783 0.3814037 0.3819203 0.3824271 0.3829283
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        X1617      X1618      X1619      X1620      X1621      X1622      X1623
1 0.2262869 0.2268134 0.2273240 0.2278208 0.2283026 0.2287675 0.2292159
2 0.2381114 0.2385841 0.2390423 0.2394851 0.2399127 0.2403191 0.2406990
3 0.3287556 0.3293829 0.3299969 0.3305942 0.3311708 0.3317267 0.3322633
4 0.2764092 0.2768732 0.2773351 0.2777925 0.2782429 0.2786841 0.2791164
5 0.3101998 0.3107579 0.3113057 0.3118408 0.3123583 0.3128575 0.3133377
6 0.3834256 0.3839192 0.3844060 0.3848838 0.3853505 0.3858038 0.3862464
        X1624      X1625      X1626      X1627      X1628      X1629      X1630
1 0.2296460 0.2300552 0.2304450 0.2308189 0.2311800 0.2315280 0.2318617
2 0.2410590 0.2414042 0.2417350 0.2420529 0.2423598 0.2426552 0.2429365
3 0.3327786 0.3332710 0.3337413 0.3341916 0.3346259 0.3350430 0.3354457
4 0.2795388 0.2799499 0.2803509 0.2807446 0.2811326 0.2815136 0.2818885
5 0.3138000 0.3142454 0.3146720 0.3150815 0.3154759 0.3158528 0.3162150
6 0.3866776 0.3870930 0.3874954 0.3878876 0.3882680 0.3886397 0.3889991
        X1631      X1632      X1633      X1634      X1635      X1636      X1637
1 0.2321809 0.2324870 0.2327819 0.2330711 0.2333591 0.2336418 0.2339146
2 0.2432040 0.2434596 0.2437041 0.2439398 0.2441693 0.2443956 0.2446180
3 0.3358387 0.3362203 0.3365889 0.3369452 0.3372918 0.3376292 0.3379577
4 0.2822595 0.2826238 0.2829792 0.2833265 0.2836672 0.2840000 0.2843235
5 0.3165675 0.3169127 0.3172493 0.3175777 0.3179016 0.3182165 0.3185189
6 0.3893393 0.3896641 0.3899781 0.3902870 0.3905943 0.3908946 0.3911849
        X1638      X1639      X1640      X1641      X1642      X1643      X1644
1 0.2341766 0.2344278 0.2346734 0.2349164 0.2351529 0.2353823 0.2356118
2 0.2448348 0.2450468 0.2452562 0.2454649 0.2456695 0.2458667 0.2460603
3 0.3382766 0.3385858 0.3388922 0.3391985 0.3394993 0.3397921 0.3400789
4 0.2846353 0.2849344 0.2852236 0.2855069 0.2857827 0.2860483 0.2863050
5 0.3188095 0.3190883 0.3193617 0.3196335 0.3198992 0.3201547 0.3204022
6 0.3914710 0.3917536 0.3920313 0.3923035 0.3925685 0.3928239 0.3930668
        X1645      X1646      X1647      X1648      X1649      X1650      X1651
1 0.2358418 0.2360673 0.2362879 0.2365069 0.2367239 0.2369355 0.2371418
2 0.2462543 0.2464482 0.2466396 0.2468318 0.2470258 0.2472167 0.2474030
3 0.3403606 0.3406394 0.3409150 0.3411905 0.3414667 0.3417394 0.3420081
4 0.2865520 0.2867925 0.2870274 0.2872594 0.2874895 0.2877081 0.2879131
5 0.3206438 0.3208793 0.3211072 0.3213338 0.3215627 0.3217910 0.3220156
6 0.3933018 0.3935293 0.3937473 0.3939683 0.3941937 0.3944085 0.3946079
        X1652      X1653      X1654      X1655      X1656      X1657      X1658
1 0.2373430 0.2375374 0.2377298 0.2379202 0.2381025 0.2382777 0.2384464
2 0.2475839 0.2477593 0.2479299 0.2480957 0.2482596 0.2484220 0.2485777
3 0.3422683 0.3425181 0.3427625 0.3430016 0.3432352 0.3434634 0.3436811
4 0.2881071 0.2882903 0.2884649 0.2886325 0.2887948 0.2889504 0.2890879
5 0.3222298 0.3224338 0.3226329 0.3228267 0.3230149 0.3231977 0.3233718
6 0.3947925 0.3949658 0.3951312 0.3952864 0.3954309 0.3955634 0.3956804
        X1659      X1660      X1661      X1662      X1663      X1664      X1665
```

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1 0.2386067 0.2387578 0.2389022 0.2390421 0.2391748 0.2392980 0.2394120
2 0.2487240 0.2488636 0.2489992 0.2491296 0.2492548 0.2493745 0.2494883
3 0.3438871 0.3440841 0.3442764 0.3444631 0.3446393 0.3448036 0.3449582
4 0.2892055 0.2893147 0.2894200 0.2895173 0.2896036 0.2896795 0.2897441
5 0.3235349 0.3236873 0.3238344 0.3239764 0.3241098 0.3242379 0.3243599
6 0.3957852 0.3958826 0.3959740 0.3960625 0.3961451 0.3962171 0.3962797
        X1666     X1667     X1668     X1669     X1670     X1671     X1672
1 0.2395163 0.2396129 0.2397037 0.2397886 0.2398700 0.2399458 0.2400099
2 0.2495934 0.2496911 0.2497839 0.2498725 0.2499627 0.2500497 0.2501230
3 0.3451034 0.3452394 0.3453664 0.3454886 0.3456130 0.3457335 0.3458414
4 0.2897974 0.2898413 0.2898750 0.2898957 0.2899071 0.2899120 0.2899064
5 0.3244722 0.3245742 0.3246686 0.3247577 0.3248441 0.3249258 0.3249931
6 0.3963317 0.3963728 0.3964036 0.3964223 0.3964319 0.3964328 0.3964199
        X1673     X1674     X1675     X1676     X1677     X1678     X1679
1 0.2400642 0.2401082 0.2401402 0.2401635 0.2401778 0.2401804 0.2401732
2 0.2501851 0.2502376 0.2502802 0.2503177 0.2503508 0.2503774 0.2503946
3 0.3459372 0.3460187 0.3460847 0.3461394 0.3461846 0.3462194 0.3462441
4 0.2898892 0.2898591 0.2898175 0.2897670 0.2897062 0.2896358 0.2895576
5 0.3250460 0.3250873 0.3251134 0.3251261 0.3251340 0.3251370 0.3251303
6 0.3963928 0.3963528 0.3963028 0.3962373 0.3961578 0.3960756 0.3959901
        X1680     X1681     X1682     X1683     X1684     X1685     X1686
1 0.2401532 0.2401199 0.2400748 0.2400166 0.2399399 0.2398462 0.2397397
2 0.2503967 0.2503845 0.2503587 0.2503178 0.2502640 0.2502012 0.2501263
3 0.3462550 0.3462515 0.3462316 0.3461912 0.3461304 0.3460539 0.3459618
4 0.2894672 0.2893619 0.2892432 0.2891098 0.2889619 0.2888046 0.2886404
5 0.3251086 0.3250725 0.3250264 0.3249670 0.3248903 0.3248004 0.3246988
6 0.3958952 0.3957872 0.3956632 0.3955267 0.3953807 0.3952283 0.3950689
        X1687     X1688     X1689     X1690     X1691     X1692     X1693
1 0.2396207 0.2394893 0.2393431 0.2391777 0.2389914 0.2387851 0.2385614
2 0.2500394 0.2499416 0.2498287 0.2496981 0.2495477 0.2493784 0.2491911
3 0.3458533 0.3457276 0.3455843 0.3454193 0.3452314 0.3450258 0.3447997
4 0.2884684 0.2882866 0.2880950 0.2878921 0.2876761 0.2874523 0.2872206
5 0.3245816 0.3244439 0.3242870 0.3241128 0.3239214 0.3237165 0.3234964
6 0.3948965 0.3947133 0.3945232 0.3943260 0.3941157 0.3938823 0.3936240
        X1694     X1695     X1696     X1697     X1698     X1699     X1700
1 0.2383207 0.2380638 0.2377853 0.2374780 0.2371510 0.2368117 0.2364586
2 0.2489824 0.2487516 0.2484996 0.2482253 0.2479318 0.2476217 0.2472975
3 0.3445473 0.3442742 0.3439816 0.3436609 0.3433173 0.3429565 0.3425747
4 0.2869754 0.2867188 0.2864521 0.2861683 0.2858688 0.2855575 0.2852356
5 0.3232546 0.3229923 0.3227131 0.3224117 0.3220914 0.3217582 0.3214129
6 0.3933455 0.3930472 0.3927373 0.3924255 0.3921011 0.3917541 0.3913933
        X1701     X1702     X1703     X1704     X1705     X1706     X1707
1 0.2360921 0.2357135 0.2353234 0.2349208 0.2345073 0.2340888 0.2336658
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2 0.2469600 0.2466062 0.2462390 0.2458665 0.2454869 0.2450975 0.2446987
3 0.3421760 0.3417666 0.3413405 0.3408965 0.3404419 0.3399834 0.3395186
4 0.2849079 0.2845740 0.2842316 0.2838844 0.2835389 0.2831986 0.2828563
5 0.3210593 0.3206955 0.3203175 0.3199300 0.3195377 0.3191414 0.3187375
6 0.3910225 0.3906497 0.3902841 0.3899157 0.3895401 0.3891638 0.3887897
        X1708     X1709     X1710     X1711     X1712     X1713     X1714
1 0.2332399 0.2328121 0.2323728 0.2319238 0.2314804 0.2310419 0.2306007
2 0.2442955 0.2438914 0.2434805 0.2430650 0.2426572 0.2422578 0.2418611
3 0.3390451 0.3385690 0.3380886 0.3376014 0.3371103 0.3366135 0.3361083
4 0.2825105 0.2821711 0.2818333 0.2814893 0.2811431 0.2807962 0.2804474
5 0.3183276 0.3179191 0.3175068 0.3170880 0.3166740 0.3162641 0.3158511
6 0.3884169 0.3880455 0.3876734 0.3872994 0.3869288 0.3865641 0.3862039
        X1715     X1716     X1717     X1718     X1719     X1720     X1721
1 0.2301567 0.2297096 0.2292564 0.2287978 0.2283391 0.2278848 0.2274326
2 0.2414640 0.2410625 0.2406546 0.2402458 0.2398385 0.2394287 0.2390135
3 0.3355994 0.3350906 0.3345768 0.3340543 0.3335299 0.3330135 0.3324962
4 0.2801013 0.2797557 0.2794070 0.2790598 0.2787170 0.2783814 0.2780543
5 0.3154342 0.3150095 0.3145793 0.3141504 0.3137273 0.3133152 0.3129056
6 0.3858495 0.3855057 0.3851729 0.3848456 0.3845171 0.3841880 0.3838606
        X1722     X1723     X1724     X1725     X1726     X1727     X1728
1 0.2269757 0.2265133 0.2260506 0.2255857 0.2251143 0.2246380 0.2241595
2 0.2385916 0.2381657 0.2377429 0.2373234 0.2368974 0.2364623 0.2360312
3 0.3319675 0.3314344 0.3309060 0.3303805 0.3298470 0.3293001 0.3287497
4 0.2777316 0.2774111 0.2770936 0.2767795 0.2764648 0.2761408 0.2758141
5 0.3124889 0.3120673 0.3116398 0.3112061 0.3107689 0.3103274 0.3098841
6 0.3835417 0.3832292 0.3829144 0.3826007 0.3822922 0.3819891 0.3816812
        X1729     X1730     X1731     X1732     X1733     X1734     X1735
1 0.2236768 0.2231880 0.2226957 0.2221986 0.2216955 0.2211877 0.2206640
2 0.2356032 0.2351673 0.2347224 0.2342703 0.2338180 0.2333687 0.2329099
3 0.3281955 0.3276261 0.3270467 0.3264616 0.3258702 0.3252745 0.3246737
4 0.2754895 0.2751594 0.2748295 0.2745029 0.2741763 0.2738529 0.2735289
5 0.3094376 0.3089806 0.3085147 0.3080472 0.3075818 0.3071201 0.3066588
6 0.3813614 0.3810317 0.3806993 0.3803717 0.3800452 0.3797110 0.3793801
        X1736     X1737     X1738     X1739     X1740     X1741     X1742
1 0.2201230 0.2195820 0.2190474 0.2185148 0.2179871 0.2174632 0.2169353
2 0.2324409 0.2319689 0.2314924 0.2310091 0.2305257 0.2300466 0.2295653
3 0.3240700 0.3234612 0.3228479 0.3222334 0.3216186 0.3210001 0.3203749
4 0.2731991 0.2728620 0.2725210 0.2721856 0.2718579 0.2715361 0.2712181
5 0.3061911 0.3057074 0.3052153 0.3047275 0.3042440 0.3037603 0.3032732
6 0.3790629 0.3787477 0.3784347 0.3781344 0.3778396 0.3775437 0.3772520
        X1743     X1744     X1745     X1746     X1747     X1748     X1749
1 0.2163981 0.2158592 0.2153320 0.2148113 0.2142840 0.2137545 0.2132259
2 0.2290798 0.2285957 0.2281210 0.2276527 0.2271886 0.2267302 0.2262751
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3 0.3197342 0.3190841 0.3184395 0.3177970 0.3171538 0.3165186 0.3159000
4 0.2708973 0.2705791 0.2702694 0.2699622 0.2696572 0.2693544 0.2690571
5 0.3027809 0.3022880 0.3018004 0.3013083 0.3008090 0.3003173 0.2998384
6 0.3769568 0.3766606 0.3763773 0.3760951 0.3758098 0.3755311 0.3752433
          X1750     X1751     X1752     X1753     X1754     X1755     X1756
1 0.2126891 0.2121379 0.2115758 0.2110150 0.2104654 0.2099302 0.2094032
2 0.2258181 0.2253489 0.2248737 0.2243951 0.2239216 0.2234652 0.2230084
3 0.3152769 0.3146339 0.3139818 0.3133163 0.3126546 0.3120102 0.3113636
4 0.2687656 0.2684749 0.2681833 0.2678770 0.2675753 0.2672939 0.2670011
5 0.2993545 0.2988524 0.2983475 0.2978496 0.2973658 0.2969021 0.2964307
6 0.3749381 0.3746260 0.3743196 0.3740273 0.3737338 0.3734274 0.3731341
          X1757     X1758     X1759     X1760     X1761     X1762     X1763
1 0.2088671 0.2083140 0.2077603 0.2072291 0.2068291 0.2064237 0.2060484
2 0.2225399 0.2220670 0.2215910 0.2211379 0.2207055 0.2203208 0.2199840
3 0.3107023 0.3100396 0.3093939 0.3087885 0.3083607 0.3079227 0.3074883
4 0.2666937 0.2663976 0.2661145 0.2658542 0.2656095 0.2653642 0.2651204
5 0.2959318 0.2954236 0.2949180 0.2944402 0.2942072 0.2940087 0.2938192
6 0.3728682 0.3726223 0.3724059 0.3721940 0.3720544 0.3719685 0.3719115
          X1764     X1765     X1766     X1767     X1768     X1769     X1770
1 0.2057105 0.2053654 0.2049672 0.2045195 0.2040776 0.2036643 0.2032917
2 0.2196842 0.2193315 0.2189102 0.2184435 0.2180057 0.2176500 0.2173563
3 0.3070837 0.3066982 0.3062911 0.3058229 0.3053482 0.3049106 0.3044821
4 0.2648803 0.2646725 0.2645277 0.2643551 0.2641476 0.2639817 0.2638261
5 0.2936223 0.2934192 0.2931514 0.2927047 0.2922066 0.2917683 0.2913946
6 0.3718161 0.3716823 0.3715345 0.3713383 0.3711360 0.3708599 0.3704200
          X1771     X1772     X1773     X1774     X1775     X1776     X1777
1 0.2029434 0.2025632 0.2021326 0.2017493 0.2015107 0.2014019 0.2013974
2 0.2170716 0.2167461 0.2163981 0.2160696 0.2157195 0.2154109 0.2152766
3 0.3040306 0.3035584 0.3031024 0.3027107 0.3023036 0.3019129 0.3017441
4 0.2636318 0.2634387 0.2633397 0.2633716 0.2634187 0.2634638 0.2636361
5 0.2910351 0.2906582 0.2902835 0.2899275 0.2895697 0.2892284 0.2890885
6 0.3698879 0.3695646 0.3695590 0.3697057 0.3698266 0.3700557 0.3704518
          X1778     X1779     X1780     X1781     X1782     X1783     X1784
1 0.2014098 0.2013674 0.2012641 0.2010527 0.2006905 0.2003835 0.2002244
2 0.2152743 0.2152912 0.2152552 0.2151082 0.2148706 0.2147694 0.2150499
3 0.3016589 0.3014695 0.3011763 0.3007980 0.3002180 0.2993630 0.2985086
4 0.2638715 0.2640111 0.2640386 0.2639834 0.2637954 0.2634954 0.2633281
5 0.2890696 0.2889065 0.2885961 0.2883227 0.2881109 0.2877918 0.2874379
6 0.3707210 0.3709137 0.3713382 0.3720438 0.3727298 0.3733247 0.3737867
          X1785     X1786     X1787     X1788     X1789     X1790     X1791
1 0.1998157 0.1993101 0.1990892 0.1989554 0.1987388 0.1986929 0.1987259
2 0.2152451 0.2152467 0.2154563 0.2159508 0.2165932 0.2171827 0.2171197
3 0.2980179 0.2980593 0.2983971 0.2985988 0.2986177 0.2986620 0.2987257
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4 0.2629099 0.2624129 0.2623625 0.2626270 0.2629581 0.2632890 0.2636303
5 0.2870334 0.2867651 0.2867058 0.2866692 0.2866753 0.2868758 0.2868953
6 0.3742239 0.3751649 0.3760607 0.3764014 0.3763851 0.3764480 0.3763450
        X1792     X1793     X1794     X1795     X1796     X1797     X1798
1 0.1988711 0.1984144 0.1976284 0.1962173 0.1946732 0.1932082 0.1917248
2 0.2168963 0.2171035 0.2166402 0.2154118 0.2137418 0.2117957 0.2102273
3 0.2983847 0.2974604 0.2965453 0.2957514 0.2945191 0.2928041 0.2917638
4 0.2637709 0.2635267 0.2628646 0.2618938 0.2601635 0.2576811 0.2559364
5 0.2864989 0.2851820 0.2830307 0.2813785 0.2799362 0.2784809 0.2769588
6 0.3753225 0.3733279 0.3715409 0.3695921 0.3673403 0.3652426 0.3626960
        X1799     X1800     X1950     X1951     X1952     X1953     X1954
1 0.1906718 0.1904999 0.03047545 0.03018970 0.03018990 0.03053407 0.03077546
2 0.2092905 0.2088893 0.05113750 0.05045666 0.04997942 0.04989860 0.04998260
3 0.2914219 0.2910444 0.06283956 0.06289930 0.06311692 0.06351042 0.06399890
4 0.2545203 0.2543792 0.12491714 0.12537521 0.12592362 0.12656253 0.12711805
5 0.2755571 0.2746925 0.08655858 0.08656851 0.08679956 0.08717518 0.08766641
6 0.3596675 0.3573149 0.19497903 0.19530642 0.19543145 0.19526170 0.19526638
        X1955      X1956      X1957      X1958      X1959      X1960      X1961
1 0.03097676 0.03117981 0.03121856 0.03135243 0.03178815 0.03210809 0.03239579
2 0.05001205 0.04997688 0.04991840 0.04981937 0.04977012 0.04975137 0.04965257
3 0.06454970 0.06512602 0.06577880 0.06644493 0.06696929 0.06738906 0.06776663
4 0.12757102 0.12802672 0.12852595 0.12900682 0.12930636 0.12944493 0.12959153
5 0.08825517 0.08899686 0.09001588 0.09102339 0.09154535 0.09168868 0.09184041
6 0.19582393 0.19656979 0.19658954 0.19611975 0.19573153 0.19543347 0.19542957
        X1962      X1963      X1964      X1965      X1966      X1967      X1968
1 0.03263473 0.03270433 0.03280672 0.03299941 0.03325490 0.03353164 0.03374136
2 0.04946356 0.04942470 0.04954046 0.04980106 0.05009943 0.05039381 0.05079265
3 0.06808949 0.06842134 0.06877592 0.06919345 0.06979247 0.07048107 0.07097895
4 0.12977031 0.12991226 0.12998160 0.13011069 0.13039156 0.13077410 0.13115241
5 0.09202577 0.09219948 0.09233746 0.09258400 0.09300245 0.09347387 0.09388340
6 0.19580255 0.19655249 0.19762525 0.19871322 0.19961205 0.20044635 0.20150328
        X1969      X1970      X1971      X1972      X1973      X1974      X1975
1 0.03392541 0.03415180 0.03442730 0.03471665 0.03500762 0.03529999 0.03564736
2 0.05126512 0.05167594 0.05203648 0.05238062 0.05271502 0.05311777 0.05360375
3 0.07132286 0.07168492 0.07205040 0.07239629 0.07273622 0.07314814 0.07363394
4 0.13151946 0.13191047 0.13232883 0.13277493 0.13324754 0.13379769 0.13441723
5 0.09424623 0.09459560 0.09495223 0.09542470 0.09600696 0.09658304 0.09713637
6 0.20276617 0.20377959 0.20457503 0.20526526 0.20589414 0.20655805 0.20722525
        X1976      X1977      X1978      X1979      X1980      X1981      X1982
1 0.03601965 0.03641964 0.03685028 0.03728655 0.03772709 0.03820746 0.03872480
2 0.05408560 0.05453143 0.05493956 0.05532750 0.05572813 0.05617680 0.05666337
3 0.07415389 0.07468010 0.07521996 0.07575885 0.07629205 0.07687169 0.07749164
4 0.13503761 0.13563539 0.13622312 0.13680588 0.13738058 0.13795899 0.13853789
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5 0.09769387 0.09829737 0.09891677 0.09946046 0.09993765 0.10042836 0.10092660
6 0.20789129 0.20859993 0.20930707 0.20991998 0.21044887 0.21096940 0.21148392
        X1983      X1984      X1985      X1986      X1987      X1988      X1989
1 0.03922850 0.03971336 0.04021222 0.04073239 0.04125122 0.04174282 0.04219728
2 0.05714996 0.05763528 0.05810900 0.05856732 0.05901486 0.05946192 0.05991824
3 0.07811385 0.07873618 0.07937114 0.08000778 0.08064340 0.08129570 0.08196409
4 0.13909991 0.13964470 0.14018648 0.14072652 0.14125820 0.14177821 0.14229509
5 0.10145207 0.10202091 0.10258615 0.10311059 0.10365535 0.10426533 0.10490553
6 0.21200593 0.21252769 0.21307458 0.21367135 0.21433221 0.21506921 0.21586225
        X1990      X1991      X1992      X1993      X1994      X1995      X1996
1 0.04260571 0.04297731 0.04337327 0.04379056 0.04422533 0.04467803 0.04513200
2 0.06038664 0.06086887 0.06135970 0.06185542 0.06237662 0.06292561 0.06343830
3 0.08261889 0.08326060 0.08391429 0.08457811 0.08525608 0.08594436 0.08662204
4 0.14282462 0.14337228 0.14392678 0.14448294 0.14503551 0.14558064 0.14611122
5 0.10554194 0.10618852 0.10685622 0.10753784 0.10824077 0.10896255 0.10966419
6 0.21666950 0.21749260 0.21831260 0.21912169 0.21990073 0.22065305 0.22137024
        X1997      X1998      X1999      X2000      X2001      X2002      X2003
1 0.04557926 0.04601029 0.04642673 0.04684288 0.04726749 0.04770488 0.04814795
2 0.06390269 0.06437006 0.06486752 0.06537378 0.06586547 0.06634692 0.06682281
3 0.08728432 0.08795205 0.08863564 0.08931704 0.08997695 0.09062563 0.09127357
4 0.14662689 0.14713138 0.14762771 0.14811104 0.14857842 0.14904172 0.14950415
5 0.11033851 0.11101211 0.11169396 0.11237063 0.11302917 0.11367666 0.11431263
6 0.22205434 0.22273234 0.22342054 0.22410922 0.22478342 0.22544025 0.22608373
        X2004      X2005      X2006      X2007      X2008      X2009      X2010
1 0.04858557 0.04900769 0.04941733 0.04982257 0.05022807 0.05063299 0.05103151
2 0.06729678 0.06777017 0.06823366 0.06868104 0.06911676 0.06955507 0.06999737
3 0.09191956 0.09256134 0.09319650 0.09383426 0.09447150 0.09509671 0.09570704
4 0.14995931 0.15040486 0.15083614 0.15125682 0.15166944 0.15207183 0.15246151
5 0.11493362 0.11554600 0.11614488 0.11672727 0.11729505 0.11786168 0.11842694
6 0.22670874 0.22732345 0.22793292 0.22853561 0.22913022 0.22972764 0.23032848
        X2011      X2012      X2013      X2014      X2015      X2016      X2017
1 0.05142873 0.05182853 0.05222494 0.05261799 0.05299955 0.05336718 0.05373078
2 0.07043216 0.07085847 0.07128849 0.07171974 0.07213013 0.07251904 0.07289096
3 0.09630740 0.09690274 0.09749541 0.09807789 0.09865703 0.09923796 0.09980599
4 0.15284281 0.15322060 0.15360759 0.15400861 0.15441286 0.15480075 0.15515973
5 0.11897086 0.11949457 0.12002830 0.12058306 0.12114423 0.12168729 0.12220289
6 0.23091940 0.23148961 0.23203105 0.23255629 0.23308848 0.23361849 0.23412718
        X2018      X2019      X2020      X2021      X2022      X2023      X2024
1 0.05408921 0.05444500 0.05479833 0.05514898 0.05549970 0.05585067 0.05619939
2 0.07325786 0.07363233 0.07400462 0.07436611 0.07472843 0.07509741 0.07546626
3 0.10036108 0.10090718 0.10144454 0.10197067 0.10248262 0.10298353 0.10347790
4 0.15550157 0.15583423 0.15615787 0.15647073 0.15677183 0.15706064 0.15733359
5 0.12269808 0.12317981 0.12365245 0.12411342 0.12456107 0.12499977 0.12543899
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6 0.23461288 0.23507856 0.23552691 0.23595908 0.23638290 0.23680283 0.23720951
        X2025      X2026      X2027      X2028      X2029      X2030      X2031
1 0.05654062 0.05686716 0.05718478 0.05749442 0.05779897 0.05810044 0.05838885
2 0.07583487 0.07619766 0.07654896 0.07689119 0.07722167 0.07753808 0.07784422
3 0.10396609 0.10444512 0.10491484 0.10537397 0.10582213 0.10626003 0.10668205
4 0.15758931 0.15783651 0.15807798 0.15830649 0.15852240 0.15873552 0.15894446
5 0.12587604 0.12630165 0.12671360 0.12710229 0.12747596 0.12785054 0.12821650
6 0.23758595 0.23792947 0.23825751 0.23858898 0.23891395 0.23921986 0.23950285
        X2032      X2033      X2034      X2035      X2036      X2037      X2038
1 0.05866383 0.05892750 0.05917910 0.05942054 0.05965677 0.05988867 0.06010362
2 0.07814584 0.07844269 0.07873303 0.07901910 0.07930752 0.07960338 0.07990082
3 0.10708654 0.10748167 0.10787552 0.10827026 0.10867216 0.10908223 0.10948724
4 0.15914280 0.15932760 0.15950031 0.15966976 0.15984520 0.16002167 0.16018530
5 0.12857115 0.12891058 0.12922741 0.12951439 0.12976823 0.12999662 0.13022578
6 0.23977533 0.24005156 0.24034052 0.24062447 0.24087508 0.24109592 0.24130999
        X2039      X2040      X2041      X2042      X2043      X2044      X2045
1 0.06030018 0.06050990 0.06075053 0.06101298 0.06129278 0.06158197 0.06188703
2 0.08020099 0.08050277 0.08080429 0.08110495 0.08140825 0.08172105 0.08204529
3 0.10988999 0.11029634 0.11070791 0.11110061 0.11146814 0.11183065 0.11220942
4 0.16034345 0.16051426 0.16070289 0.16087261 0.16102475 0.16117864 0.16133705
5 0.13046642 0.13071239 0.13097325 0.13122915 0.13148075 0.13174741 0.13204082
6 0.24151835 0.24170551 0.24187509 0.24207428 0.24231362 0.24258093 0.24288182
        X2046      X2047      X2048      X2049      X2050      X2051      X2052
1 0.06221581 0.06257069 0.06292654 0.06325658 0.06357920 0.06392986 0.06430283
2 0.08237023 0.08268521 0.08299314 0.08330271 0.08361653 0.08394055 0.08427710
3 0.11261213 0.11303790 0.11349110 0.11397303 0.11446507 0.11493012 0.11537544
4 0.16148656 0.16161763 0.16175097 0.16191073 0.16209380 0.16228246 0.16247253
5 0.13234754 0.13265221 0.13296097 0.13329074 0.13364136 0.13399957 0.13436097
6 0.24317411 0.24342465 0.24365290 0.24388762 0.24413006 0.24438113 0.24463501
        X2053      X2054      X2055      X2056      X2057      X2058      X2059
1 0.06467185 0.06503753 0.06539874 0.06575095 0.06609934 0.06644569 0.06678911
2 0.08461828 0.08496077 0.08530372 0.08564450 0.08598272 0.08631723 0.08665599
3 0.11583839 0.11631481 0.11678685 0.11725355 0.11771643 0.11817920 0.11864573
4 0.16266921 0.16287579 0.16307798 0.16327261 0.16346910 0.16366606 0.16385601
5 0.13471537 0.13506224 0.13540750 0.13574952 0.13609036 0.13642900 0.13676278
6 0.24486760 0.24508644 0.24529261 0.24547682 0.24565751 0.24584405 0.24604649
        X2060      X2061      X2062      X2063      X2064      X2065      X2066
1 0.06712923 0.06746869 0.06780553 0.06813633 0.06846544 0.06879565 0.06912336
2 0.08700209 0.08734585 0.08766956 0.08797316 0.08827427 0.08857984 0.08888469
3 0.11911521 0.11958455 0.12005122 0.12051436 0.12097302 0.12142418 0.12187483
4 0.16404110 0.16422733 0.16441327 0.16459714 0.16477880 0.16495974 0.16514400
5 0.13709235 0.13742269 0.13774628 0.13806345 0.13839496 0.13874535 0.13909526
6 0.24626452 0.24648269 0.24669849 0.24691454 0.24712523 0.24732743 0.24752937
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	X2067	X2068	X2069	X2070	X2071	X2072	X2073
1	0.06944586	0.06977190	0.07010622	0.07044393	0.07077854	0.07110489	0.07141736
2	0.08918385	0.08948897	0.08979930	0.09011153	0.09042688	0.09073764	0.09103706
3	0.12233151	0.12279628	0.12326151	0.12372208	0.12417818	0.12462644	0.12506792
4	0.16533348	0.16553638	0.16574908	0.16596533	0.16618413	0.16639881	0.16661318
5	0.13943988	0.13978876	0.14013952	0.14049780	0.14086568	0.14122828	0.14158034
6	0.24773701	0.24794586	0.24815793	0.24837952	0.24860346	0.24882487	0.24903762

	X2074	X2075	X2076	X2077	X2078	X2079	X2080
1	0.07172255	0.07203402	0.07235057	0.07266430	0.07297597	0.07329296	0.07361510
2	0.09133012	0.09162008	0.09190514	0.09218209	0.09245173	0.09272802	0.09301789
3	0.12550490	0.12593749	0.12636577	0.12679573	0.12722997	0.12766408	0.12809776
4	0.16683079	0.16705027	0.16727180	0.16749971	0.16773318	0.16797101	0.16821384
5	0.14192708	0.14227403	0.14262302	0.14297962	0.14334347	0.14370667	0.14407054
6	0.24924953	0.24947716	0.24971791	0.24995749	0.25019305	0.25042586	0.25065703

	X2081	X2082	X2083	X2084	X2085	X2086	X2087
1	0.07393457	0.07425662	0.07457846	0.07489284	0.07520586	0.07552150	0.07583905
2	0.09331200	0.09360170	0.09388602	0.09416650	0.09443701	0.09469455	0.09494927
3	0.12853318	0.12897054	0.12940279	0.12982938	0.13024442	0.13064375	0.13103402
4	0.16846202	0.16871857	0.16897714	0.16923559	0.16949453	0.16975286	0.17001626
5	0.14444002	0.14481642	0.14519018	0.14555912	0.14591956	0.14626742	0.14661177
6	0.25089231	0.25113163	0.25137702	0.25162717	0.25188079	0.25213367	0.25238796

	X2088	X2089	X2090	X2091	X2092	X2093	X2094
1	0.07616165	0.07648533	0.07680190	0.07711009	0.07740540	0.07769003	0.07797420
2	0.09521008	0.09547432	0.09573437	0.09598997	0.09624664	0.09650271	0.09674631
3	0.13142441	0.13181566	0.13221425	0.13261929	0.13302446	0.13343005	0.13383123
4	0.17029755	0.17059567	0.17089943	0.17120523	0.17151369	0.17182583	0.17212864
5	0.14696013	0.14730772	0.14764466	0.14797419	0.14832023	0.14868426	0.14903611
6	0.25265937	0.25294277	0.25322523	0.25350445	0.25377256	0.25403052	0.25430729

	X2095	X2096	X2097	X2098	X2099	X2100	X2101
1	0.0782590	0.07855150	0.07885664	0.07916924	0.07948498	0.07979623	0.08009847
2	0.0969770	0.09721405	0.09746629	0.09773553	0.09801597	0.09828985	0.09854943
3	0.1342267	0.13461094	0.13498392	0.13536529	0.13575777	0.13614767	0.13652593
4	0.1724175	0.17270379	0.17299214	0.17329357	0.17360460	0.17391123	0.17420920
5	0.1493689	0.14969758	0.15002797	0.15036603	0.15071466	0.15106396	0.15140697
6	0.2546076	0.25490116	0.25517688	0.25544716	0.25571801	0.25598946	0.25626285

	X2102	X2103	X2104	X2105	X2106	X2107	X2108
1	0.08038763	0.08066274	0.08092646	0.08117730	0.08141840	0.08166271	0.08190856
2	0.09879913	0.09904066	0.09927658	0.09951301	0.09974775	0.09997966	0.10021099
3	0.13689890	0.13728147	0.13766604	0.13803791	0.13840329	0.13877228	0.13914132
4	0.17449855	0.17478718	0.17508222	0.17538788	0.17570142	0.17601088	0.17631494
5	0.15174568	0.15208338	0.15241907	0.15273950	0.15304740	0.15335331	0.15365604
6	0.25653288	0.25679689	0.25706066	0.25732924	0.25760438	0.25788945	0.25818406

	X2109	X2110	X2111	X2112	X2113	X2114	X2115

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1 0.08215029 0.08238814 0.08263079 0.08288178 0.08313869 0.08339739 0.08365552
2 0.10044863 0.10069242 0.10094358 0.10120275 0.10146295 0.10171837 0.10196889
3 0.13950506 0.13986381 0.14022029 0.14057831 0.14094028 0.14130123 0.14165830
4 0.17661870 0.17692423 0.17723059 0.17753615 0.17784256 0.17815149 0.17846631
5 0.15396344 0.15427718 0.15458750 0.15489533 0.15520443 0.15550932 0.15580862
6 0.25847101 0.25874834 0.25903300 0.25933238 0.25964227 0.25995666 0.26027108
          X2116       X2117       X2118       X2119       X2120       X2121       X2122
1 0.08391577 0.08417766 0.0844316 0.08468132 0.08493526 0.08518918 0.08543841
2 0.10221867 0.10246590 0.1027063 0.10294050 0.10317300 0.10340733 0.10364278
3 0.14201653 0.14237997 0.1427452 0.14311080 0.14347447 0.14383737 0.14419909
4 0.17878807 0.17912088 0.1794627 0.17980156 0.18013202 0.18045652 0.18077605
5 0.15610854 0.15641084 0.1567156 0.15701771 0.15731744 0.15761941 0.15791993
6 0.26058435 0.26089381 0.2612007 0.26150557 0.26180634 0.26210550 0.26240241
          X2123       X2124       X2125       X2126       X2127       X2128       X2129
1 0.08568214 0.08592689 0.08617618 0.08642545 0.0866725 0.08691689 0.08715795
2 0.10387433 0.10409530 0.10431151 0.10453795 0.1047721 0.10501183 0.10525675
3 0.14455597 0.14491172 0.14527288 0.14563848 0.1460040 0.14635899 0.14669897
4 0.18108621 0.18137716 0.18165451 0.18193472 0.1822193 0.18250497 0.18278707
5 0.15821662 0.15850657 0.15879102 0.15907208 0.1593528 0.15963907 0.15992831
6 0.26268869 0.26295873 0.26321897 0.26347477 0.2637226 0.26396237 0.26419734
          X2130       X2131       X2132       X2133       X2134       X2135       X2136
1 0.08739771 0.08763783 0.08787628 0.08810877 0.08833935 0.08857252 0.08880477
2 0.10550257 0.10575010 0.10599494 0.10623019 0.10645801 0.10668438 0.10691556
3 0.14703232 0.14736748 0.14769911 0.14802310 0.14834577 0.14867328 0.14900442
4 0.18306270 0.18333214 0.18359181 0.18384557 0.18409546 0.18433844 0.18457619
5 0.16021253 0.16049185 0.16076698 0.16103513 0.16130010 0.16157043 0.16184437
6 0.26443248 0.26466867 0.26490344 0.26513926 0.26537626 0.26561291 0.26585323
          X2137       X2138       X2139       X2140       X2141       X2142       X2143
1 0.08903485 0.08926854 0.08950762 0.0897451 0.0899780 0.09020675 0.09042836
2 0.10715176 0.10739126 0.10763452 0.1078738 0.1081058 0.10833658 0.10856796
3 0.14933386 0.14966688 0.15000410 0.1503395 0.1506751 0.15100961 0.15132966
4 0.18480653 0.18503762 0.18528133 0.1855271 0.1857607 0.18598181 0.18618985
5 0.16211780 0.16239897 0.16268857 0.1629764 0.1632554 0.16352458 0.16379255
6 0.26609755 0.26633675 0.26656481 0.2667813 0.2669789 0.26716546 0.26735280
          X2144       X2145       X2146       X2147       X2148       X2149       X2150
1 0.09064727 0.09087331 0.09110412 0.09134011 0.09158103 0.09181181 0.0920265
2 0.10880014 0.10902753 0.10924338 0.10945419 0.10966642 0.10987580 0.1100810
3 0.15164020 0.15195102 0.15226319 0.15257546 0.15288002 0.15317721 0.1534776
4 0.18638752 0.18658120 0.18677212 0.18696161 0.18714697 0.18732626 0.1875055
5 0.16406983 0.16435419 0.16463367 0.16491349 0.16519963 0.16548554 0.1657691
6 0.26754211 0.26774128 0.26794698 0.26814236 0.26832306 0.26849212 0.2686453
          X2151       X2152       X2153       X2154       X2155       X2156       X2157
1 0.0922402 0.09246014 0.09268012 0.09290017 0.09312459 0.09334701 0.09355967
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2 0.1102857 0.11048986 0.11070373 0.11093250 0.11116203 0.11138792 0.11161633
3 0.1537849 0.15409215 0.15439893 0.15470525 0.15499919 0.15527546 0.15554506
4 0.1876919 0.18788273 0.18807041 0.18824788 0.18840899 0.18855750 0.18870238
5 0.1660529 0.16633672 0.16662076 0.16690447 0.16718041 0.16744544 0.16770381
6 0.2687903 0.26894062 0.26910135 0.26927583 0.26945461 0.26962477 0.26977712
        X2158       X2159       X2160       X2161       X2162       X2163       X2164
1 0.09376606 0.09396717 0.09417171 0.09438141 0.09458791 0.09479559 0.09500741
2 0.11185021 0.11208452 0.11230288 0.11249654 0.11268340 0.11287875 0.11307364
3 0.15582282 0.15609661 0.15635899 0.15661899 0.15688056 0.15715197 0.15743361
4 0.18884863 0.18899571 0.18913944 0.18927714 0.18941515 0.18955978 0.18970413
5 0.16796071 0.16821914 0.16848761 0.16876371 0.16903690 0.16930566 0.16956086
6 0.26991143 0.27004984 0.27020787 0.27037551 0.27055310 0.27073532 0.27089675
        X2165       X2166       X2167       X2168       X2169       X2170       X2171
1 0.09522244 0.09543455 0.09563968 0.09584178 0.09604032 0.09623376 0.09642362
2 0.11326604 0.11346247 0.11366426 0.11387477 0.11409399 0.11432027 0.11454903
3 0.15771669 0.15799172 0.15826866 0.15855726 0.15884704 0.15913400 0.15941663
4 0.18984329 0.18997523 0.19010102 0.19022494 0.19034326 0.19045292 0.19055911
5 0.16980177 0.17003427 0.17026798 0.17050488 0.17073711 0.17096864 0.17120727
6 0.27103705 0.27116768 0.27130298 0.27144665 0.27157533 0.27167383 0.27175153
        X2172       X2173       X2174       X2175       X2176       X2177       X2178
1 0.09661124 0.09679889 0.09698596 0.09717184 0.09736275 0.09755946 0.09776035
2 0.11477521 0.11500140 0.11522858 0.11545785 0.11568939 0.11592090 0.11614790
3 0.15969954 0.15998927 0.16027757 0.16056373 0.16084777 0.16112584 0.16139211
4 0.19067095 0.19078933 0.19091029 0.19103609 0.19117055 0.19130463 0.19142730
5 0.17145367 0.17169946 0.17193736 0.17217216 0.17241581 0.17266186 0.17289331
6 0.27181956 0.27188771 0.27195387 0.27200588 0.27205331 0.27210439 0.27215414
        X2179       X2180       X2181       X2182       X2183       X2184       X2185
1 0.09796063 0.09815862 0.09835374 0.09854357 0.09873041 0.09891565 0.09909924
2 0.11636860 0.11658567 0.11680321 0.11702241 0.11723983 0.11745846 0.11767995
3 0.16163582 0.16187027 0.16211381 0.16238295 0.16267031 0.16294949 0.16322021
4 0.19153899 0.19164184 0.19174112 0.19184958 0.19196941 0.19209813 0.19223207
5 0.17311261 0.17332657 0.17353316 0.17374367 0.17396058 0.17417997 0.17440483
6 0.27220155 0.27225245 0.27231673 0.27238858 0.27245942 0.27252212 0.27256582
        X2186       X2187       X2188       X2189       X2190      X2191      X2192
1 0.09928633 0.09948238 0.09968092 0.09987968 0.1000835 0.1002924 0.1005000
2 0.11790088 0.11811841 0.11833481 0.11855306 0.1187634 0.1189586 0.1191404
3 0.16349257 0.16375737 0.16401029 0.16426073 0.1645164 0.1647886 0.1650733
4 0.19236420 0.19249387 0.19262089 0.19274749 0.1928749 0.1930050 0.1931333
5 0.17463378 0.17486414 0.17509208 0.17531391 0.1755323 0.1757552 0.1759837
6 0.27260366 0.27264802 0.27269734 0.27275366 0.2728196 0.2729107 0.2730196
       X2193      X2194      X2195      X2196      X2197      X2198      X2199
1 0.1007028 0.1008971 0.1010828 0.1012636 0.1014334 0.1015880 0.1017361
2 0.1193155 0.1194875 0.1196627 0.1198417 0.1200209 0.1202023 0.1203863
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3 0.1653532 0.1656252 0.1658888 0.1661457 0.1664039 0.1666566 0.1669045
4 0.1932562 0.1933768 0.1934962 0.1936119 0.1937262 0.1938321 0.1939287
5 0.1762133 0.1764358 0.1766488 0.1768554 0.1770558 0.1772472 0.1774243
6 0.2731232 0.2732119 0.2732884 0.2733489 0.2733872 0.2734164 0.2734599
         X2200     X2201     X2202     X2203     X2204     X2205     X2206
1 0.1018808 0.1020244 0.1021665 0.1022952 0.1024073 0.1025145 0.1026168
2 0.1205710 0.1207431 0.1208931 0.1210282 0.1211514 0.1212740 0.1213967
3 0.1671524 0.1673910 0.1676169 0.1678298 0.1680260 0.1682151 0.1683976
4 0.1940251 0.1941188 0.1942049 0.1942819 0.1943500 0.1944195 0.1944903
5 0.1775930 0.1777551 0.1779072 0.1780493 0.1781736 0.1782843 0.1783893
6 0.2735110 0.2735616 0.2736128 0.2736362 0.2736262 0.2736148 0.2736098
         X2207     X2208     X2209     X2210     X2211     X2212     X2213
1 0.1027042 0.1027856 0.1028590 0.1029236 0.1029836 0.1030252 0.1030514
2 0.1215028 0.1216040 0.1217031 0.1217826 0.1218501 0.1219093 0.1219562
3 0.1685525 0.1686848 0.1688084 0.1689187 0.1690131 0.1690918 0.1691633
4 0.1945413 0.1945773 0.1946054 0.1946174 0.1946165 0.1946062 0.1945878
5 0.1784945 0.1786093 0.1787219 0.1788209 0.1789149 0.1789989 0.1790623
6 0.2735910 0.2735621 0.2735320 0.2734962 0.2734475 0.2733795 0.2732922
         X2214     X2215     X2216     X2217     X2218     X2219     X2220
1 0.1030724 0.1030835 0.1030911 0.1030975 0.1031000 0.1030949 0.1030786
2 0.1219929 0.1220240 0.1220535 0.1220721 0.1220827 0.1220815 0.1220519
3 0.1692326 0.1692883 0.1693246 0.1693442 0.1693626 0.1693738 0.1693548
4 0.1945552 0.1945074 0.1944538 0.1943934 0.1943311 0.1942555 0.1941392
5 0.1791045 0.1791303 0.1791384 0.1791282 0.1791069 0.1790670 0.1789995
6 0.2731922 0.2730780 0.2729326 0.2727534 0.2725436 0.2723151 0.2720817
         X2221     X2222     X2223     X2224     X2225     X2226     X2227
1 0.1030516 0.1030091 0.1029508 0.1028889 0.1028258 0.1027447 0.1026422
2 0.1220044 0.1219588 0.1219097 0.1218603 0.1218102 0.1217352 0.1216344
3 0.1693114 0.1692523 0.1691721 0.1690761 0.1689634 0.1688246 0.1686641
4 0.1939900 0.1938264 0.1936475 0.1934617 0.1932739 0.1930826 0.1928832
5 0.1789107 0.1788142 0.1787132 0.1786072 0.1784939 0.1783574 0.1781918
6 0.2718386 0.2715894 0.2713405 0.2710787 0.2707944 0.2705053 0.2702261
         X2228     X2229     X2230     X2231     X2232     X2233     X2234
1 0.1025251 0.1023965 0.1022591 0.1021138 0.1019503 0.1017618 0.1015470
2 0.1215091 0.1213599 0.1212035 0.1210485 0.1209069 0.1207709 0.1206125
3 0.1684909 0.1683068 0.1680987 0.1678583 0.1676050 0.1673508 0.1670826
4 0.1926634 0.1924225 0.1921706 0.1919041 0.1916172 0.1913135 0.1909964
5 0.1780026 0.1777928 0.1775592 0.1772981 0.1770121 0.1767088 0.1763947
6 0.2699442 0.2696514 0.2693464 0.2690292 0.2686961 0.2683378 0.2679463
         X2235     X2236     X2237     X2238     X2239     X2240     X2241
1 0.1013181 0.1010823 0.1008379 0.1005895 0.1003370 0.1000809 0.09981321
2 0.1204212 0.1202037 0.1199724 0.1197281 0.1194683 0.1191995 0.11893415
3 0.1667925 0.1664867 0.1661734 0.1658430 0.1654756 0.1650910 0.16470803
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4 0.1906706 0.1903347 0.1899825 0.1896201 0.1892455 0.1888502 0.18843707
5 0.1760655 0.1757277 0.1753854 0.1750327 0.1746563 0.1742520 0.17382580
6 0.2675287 0.2671096 0.2666958 0.2662824 0.2658640 0.2654196 0.26492459
        X2242       X2243       X2244       X2245       X2246       X2247       X2248
1 0.09954165 0.09928037 0.09901093 0.09872406 0.0984290 0.09812583 0.09782091
2 0.11867323 0.11840197 0.11811213 0.11781529 0.1175136 0.11719438 0.11686436
3 0.16431589 0.16391051 0.16348396 0.16303499 0.1625726 0.16210923 0.16164751
4 0.18801207 0.18757974 0.18712976 0.18665445 0.1861644 0.18568108 0.18521239
5 0.17337838 0.17292308 0.17246154 0.17198655 0.1715073 0.17103449 0.17056163
6 0.26437797 0.26379394 0.26319140 0.26259747 0.2620075 0.26142313 0.26084906
        X2249       X2250       X2251       X2252       X2253       X2254       X2255
1 0.09752416 0.09723092 0.09693802 0.09664341 0.09634123 0.09603479 0.09572662
2 0.11653508 0.11620794 0.11588177 0.11555339 0.11522071 0.11488817 0.11456186
3 0.16118611 0.16072357 0.16025145 0.15976819 0.15928380 0.15880293 0.15832084
4 0.18475294 0.18429395 0.18382391 0.18334642 0.18287145 0.18240157 0.18193167
5 0.17008819 0.16962159 0.16915051 0.16867271 0.16819819 0.16771886 0.16721953
6 0.26026401 0.25965473 0.25901845 0.25836469 0.25770511 0.25704724 0.25640955
        X2256       X2257       X2258       X2259       X2260       X2261       X2262
1 0.09541838 0.09510993 0.09480041 0.0944952 0.09419322 0.09388922 0.09358595
2 0.11423615 0.11391146 0.11359598 0.1132841 0.11296915 0.11264448 0.11231021
3 0.15783057 0.15734004 0.15685626 0.1563828 0.15592625 0.15547068 0.15500652
4 0.18145666 0.18098257 0.18051834 0.1800680 0.17962310 0.17918171 0.17875334
5 0.16671142 0.16620947 0.16571317 0.1652274 0.16474906 0.16426637 0.16378540
6 0.25579863 0.25520809 0.25462776 0.2540660 0.25352990 0.25298399 0.25240481
        X2263       X2264       X2265       X2266       X2267       X2268       X2269
1 0.09328059 0.09297341 0.0926717 0.0923735 0.09208127 0.09179119 0.09149289
2 0.11196778 0.11162130 0.1112827 0.1109496 0.11060612 0.11026164 0.10992810
3 0.15452153 0.15401135 0.1534905 0.1529719 0.15247527 0.15200286 0.15153030
4 0.17833254 0.17791188 0.1774880 0.1770638 0.17663728 0.17620755 0.17576984
5 0.16330383 0.16282284 0.1623471 0.1618638 0.16137864 0.16089910 0.16040943
6 0.25180854 0.25120975 0.2506266 0.2500712 0.24952619 0.24897863 0.24842906
        X2270       X2271       X2272       X2273       X2274       X2275       X2276
1 0.0911912 0.09088785 0.09057373 0.09025174 0.0899317 0.0896005 0.08924838
2 0.1096048 0.10928851 0.10897926 0.10867603 0.1083726 0.1080779 0.10777914
3 0.1510557 0.15057912 0.15008454 0.14958185 0.1490912 0.1486203 0.14817096
4 0.1753263 0.17489715 0.17448494 0.17407577 0.1736618 0.1732532 0.17285414
5 0.1599215 0.15944273 0.15896366 0.15848345 0.1580037 0.1575367 0.15707805
6 0.2478830 0.24733794 0.24677420 0.24619686 0.2456223 0.2450547 0.24448287
        X2277       X2278       X2279       X2280       X2281       X2282       X2283
1 0.08889165 0.08855134 0.08822689 0.08790683 0.08759112 0.08727768 0.08696445
2 0.10746712 0.10714958 0.10682693 0.10648899 0.10613856 0.10580236 0.10548348
3 0.14772948 0.14728067 0.14683872 0.14640219 0.14595145 0.14548135 0.14499727
4 0.17246663 0.17209434 0.17172666 0.17135483 0.17097139 0.17057502 0.17018457
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5 0.15662691 0.15617761 0.15572687 0.15528373 0.15482767 0.15435982 0.15391278
6 0.24391117 0.24338125 0.24288690 0.24238380 0.24187002 0.24134723 0.24080565
          X2284       X2285       X2286       X2287       X2288       X2289       X2290
1 0.08665652 0.08635452 0.08604366 0.08573069 0.08545262 0.08519533 0.08493202
2 0.10517626 0.10488564 0.10460759 0.10433438 0.10406730 0.10379498 0.10351445
3 0.14451110 0.14404186 0.14358601 0.14313105 0.14269511 0.14227465 0.14186382
4 0.16981752 0.16947681 0.16915000 0.16882387 0.16850342 0.16818098 0.16784963
5 0.15350804 0.15314412 0.15278980 0.15243425 0.15209324 0.15175258 0.15141846
6 0.24028379 0.23980161 0.23932354 0.23882816 0.23833149 0.23784052 0.23735211
          X2291       X2292       X2293       X2294       X2295       X2296       X2297
1 0.08465992 0.08437982 0.08410998 0.08385293 0.08360325 0.08336135 0.08311406
2 0.10323647 0.10294970 0.10265616 0.10236345 0.10207509 0.10180092 0.10153363
3 0.14146546 0.14107309 0.14069357 0.14032047 0.13994179 0.13955285 0.13915990
4 0.16752129 0.16720143 0.16688918 0.16658546 0.16629662 0.16602415 0.16575740
5 0.15110309 0.15077707 0.15043277 0.15007392 0.14971897 0.14937944 0.14904450
6 0.23686929 0.23638226 0.23589709 0.23543664 0.23499671 0.23457897 0.23419307
          X2298       X2299       X2300       X2301       X2302       X2303       X2304
1 0.08285789 0.08259499 0.08231889 0.08203271 0.08175702 0.08149636 0.08122433
2 0.10125523 0.10095702 0.10065471 0.10036741 0.10009052 0.09980489 0.09949687
3 0.13878646 0.13842215 0.13805383 0.13769562 0.13733968 0.13697330 0.13659632
4 0.16549012 0.16521895 0.16494074 0.16466985 0.16441665 0.16417666 0.16394170
5 0.14872132 0.14840631 0.14807652 0.14773927 0.14740275 0.14705328 0.14670191
6 0.23384081 0.23352711 0.23323124 0.23293449 0.23264282 0.23236938 0.23212986
          X2305       X2306       X2307       X2308       X2309       X2310       X2311
1 0.08093860 0.08065504 0.08037421 0.08008913 0.07979472 0.07950350 0.07922592
2 0.09916649 0.09882868 0.09850797 0.09820548 0.09791560 0.09764044 0.09737089
3 0.13621327 0.13582899 0.13545243 0.13507058 0.13467070 0.13426401 0.13387366
4 0.16370598 0.16347767 0.16326429 0.16305577 0.16284850 0.16265084 0.16245432
5 0.14636080 0.14601607 0.14567277 0.14533182 0.14497846 0.14460755 0.14423337
6 0.23190986 0.23167817 0.23141838 0.23112867 0.23084733 0.23057341 0.23028502
          X2312       X2313       X2314       X2315       X2316       X2317       X2318
1 0.07895008 0.07866744 0.07839150 0.07813184 0.0778545 0.07754413 0.07721764
2 0.09711565 0.09685807 0.09655295 0.09620886 0.0958483 0.09547696 0.09511262
3 0.13351721 0.13316905 0.13278199 0.13235100 0.1319171 0.13150068 0.13109904
4 0.16225723 0.16206752 0.16187195 0.16166529 0.1614395 0.16119875 0.16097389
5 0.14388721 0.14357069 0.14326755 0.14296581 0.1426505 0.14231347 0.14195800
6 0.22999223 0.22969723 0.22942746 0.22920076 0.2289843 0.22875662 0.22852859
          X2319       X2320       X2321       X2322       X2323       X2324       X2325
1 0.07689118 0.07658768 0.07631130 0.07604684 0.07577919 0.07551194 0.07524660
2 0.09475791 0.09442470 0.09410683 0.09378007 0.09346211 0.09315602 0.09285578
3 0.13071385 0.13034314 0.12996328 0.12956197 0.12915652 0.12875386 0.12836879
4 0.16076301 0.16055305 0.16035186 0.16014662 0.15993180 0.15970830 0.15948599
5 0.14159794 0.14127424 0.14100311 0.14074309 0.14048145 0.14019677 0.13988432
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6 0.22829980 0.22807337 0.22784136 0.22760814 0.22739975 0.22721283 0.22702842
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1 0.07496466 0.07465517 0.07434318 0.07404942 0.07376519 0.07348906 0.07319262
2 0.09254824 0.09223473 0.09194884 0.09169539 0.09145555 0.09121960 0.09096933
3 0.12800164 0.12763730 0.12728949 0.12696340 0.12664550 0.12632797 0.12599486
4 0.15929935 0.15913957 0.15897966 0.15882514 0.15866886 0.15850181 0.15833983
5 0.13959157 0.13930353 0.13900810 0.13872955 0.13845291 0.13815761 0.13784487
6 0.22682588 0.22662191 0.22640217 0.22612757 0.22582339 0.22554409 0.22530470
          X2333       X2334       X2335       X2336       X2337       X2338       X2339
1 0.07286562 0.07254690 0.07224118 0.07194172 0.07166248 0.07141382 0.0712017
2 0.09071223 0.09047169 0.09021963 0.08994323 0.08966218 0.08938828 0.0891141
3 0.12563440 0.12526439 0.12491232 0.12457555 0.12423909 0.12389378 0.1235314
4 0.15818338 0.15802375 0.15787685 0.15775419 0.15764273 0.15753520 0.1574249
5 0.13752181 0.13718417 0.13683941 0.13650385 0.13615377 0.13578216 0.1354186
6 0.22506371 0.22481536 0.22457795 0.22435460 0.22417232 0.22400690 0.2238369
          X2340       X2341       X2342       X2343       X2344       X2345       X2346
1 0.07098848 0.07073783 0.07046504 0.07019423 0.06993102 0.06964883 0.06935254
2 0.08883078 0.08855715 0.08829105 0.08801567 0.08774322 0.08746549 0.08717593
3 0.12316401 0.12279431 0.12242581 0.12208341 0.12174659 0.12136701 0.12097015
4 0.15730521 0.15719413 0.15709903 0.15699980 0.15687711 0.15672143 0.15654838
5 0.13506677 0.13471333 0.13436432 0.13403963 0.13372718 0.13340137 0.13307095
6 0.22366646 0.22347459 0.22328182 0.22306456 0.22281607 0.22258967 0.22236009
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2 0.08692133 0.08670169 0.08647373 0.08624759 0.08601941 0.08578816 0.08561187
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4 0.15637880 0.15620546 0.15601262 0.15582172 0.15563208 0.15541929 0.15517746
5 0.13275886 0.13245798 0.13214683 0.13184016 0.13153376 0.13122367 0.13091984
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4 0.15491355 0.15462321 0.15430320 0.15399396 0.15369824 0.15337545 0.15303620
5 0.13062235 0.13032886 0.13001694 0.12968260 0.12933549 0.12898197 0.12863512
6 0.22046708 0.22026079 0.22002150 0.21976715 0.21950509 0.21924901 0.21900278
          X2361       X2362       X2363       X2364       X2365       X2366       X2367
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2 0.08371445 0.0834155  0.08310976 0.08278314 0.08241845 0.08201940 0.08162227
3 0.11461261 0.1141067  0.11366636 0.11326793 0.11286161 0.11244626 0.11202732
4 0.15270424 0.1523903  0.15210104 0.15181821 0.15151794 0.15119072 0.15085306
5 0.12830201 0.1279917  0.12771042 0.12743295 0.12712195 0.12677572 0.12641421
6 0.21878063 0.2185706  0.21832919 0.21806222 0.21779386 0.21751545 0.21723632
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3 0.11161626 0.11115926 0.11066283 0.11017782 0.10969420 0.10921858 0.10874572
4 0.15052762 0.15019576 0.14984932 0.14947942 0.14909778 0.14876171 0.14845227
5 0.12604774 0.12564307 0.12522294 0.12485620 0.12451735 0.12413467 0.12370721
6 0.21698291 0.21676013 0.21654121 0.21628938 0.21601194 0.21575459 0.21553409
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2 0.07920876 0.07894573 0.07871779 0.07850039 0.07828644 0.07808026 0.07785306
3 0.10830862 0.10790730 0.10749409 0.10707454 0.10662168 0.10613403 0.10564090
4 0.14811885 0.14775687 0.14739419 0.14704512 0.14670820 0.14639068 0.14610017
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6 0.21531727 0.21510232 0.21490482 0.21474521 0.21463725 0.21452824 0.21440121
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3 0.10512573 0.10457153 0.10399994 0.10344575 0.10290705 0.10236258 0.10179963
4 0.14582019 0.14550836 0.14516374 0.14483205 0.14452271 0.14418270 0.14378828
5 0.12052019 0.12001708 0.11953589 0.11905687 0.11855530 0.11806261 0.11758331
6 0.21426451 0.21409579 0.21387817 0.21359279 0.21326660 0.21297544 0.21270541
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2 0.07539900 0.07509138 0.07474478 0.07435241 0.07394174 0.07352633 0.07315092
3 0.10122294 0.10064772 0.10007623 0.09949929 0.09892574 0.09836407 0.09785283
4 0.14337960 0.14298215 0.14260850 0.14225624 0.14189108 0.14150965 0.14115505
5 0.11708189 0.11654798 0.11597851 0.11538790 0.11479605 0.11420864 0.11366264
6 0.21236813 0.21196804 0.21155493 0.21113478 0.21073577 0.21037163 0.21001106
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1 0.05474002 0.05437206 0.05406684 0.05383195 0.05362373
2 0.07280829 0.07245442 0.07209272 0.07170453 0.07129359
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4 0.14081859 0.14042623 0.13999339 0.13957908 0.13916693
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```

> **ℹ Dataset Structure**
>
> The dataset contains:
>
> - **Month**: Sampling time (March, July)
> - **Group**: Plant functional groups (Deciduous, Evergreen)
>
> - **Class**: Specific plant classes (SP0, SP1, SP2)
> - **Biomarkers**: Chemical measurements (Chla, Chlb, C, Antho, Cellulose, Wax)

- **Spectral bands**: Reflectance values at different wavelengths (X400, X401, …, X2400)

3.2 Data Type Conversion

Next, we convert categorical variables to factors and identify spectral columns:

```
# Convert categorical variables to factors
data$Month <- factor(data$Month, levels = c("March", "July"))
data$Group <- as.factor(data$Group)
data$Class <- as.factor(data$Class)

# Identify spectral band columns (wavelengths from 400-2400 nm)
spectral_cols <- colnames(data)[grepl("^X\\d+$", colnames(data))]
cat("Number of spectral band columns found:", length(spectral_cols), "\n")
```

```
Number of spectral band columns found: 1753
```

> **!** Why Factor Conversion Matters
>
> Converting to factors ensures proper statistical analysis and visualization. The spectral columns represent reflectance measurements at specific wavelengths, forming the hyperspectral signature of each sample.

3.3 Creating Long Format for Analysis

Transform the wide spectral data into long format for easier plotting and analysis:

```
# Reshape spectral data to long format
data_long <- data %>%
  pivot_longer(cols = all_of(spectral_cols),
               names_to = "Wavelength",
               values_to = "Reflectance") %>%
  mutate(Wavelength = as.numeric(sub("X", "", Wavelength)))

# Check the data structure
print(table(data$Class, data$Group, data$Month))
```

```
, ,  = March


      Deciduous Evergreen
  SP0          0         6
  SP1          6         0
  SP2          3         0

, ,  = July


      Deciduous Evergreen
  SP0          0         6
  SP1          6         0
  SP2          3         0
```

4 Part 2: Biomarker Analysis and Visualization

4.1 Comparing Biomarkers Across Groups

Create comprehensive visualizations to compare biomarker levels across different plant groups and classes:

```r
# Prepare data for biomarker comparison
df_long <- data %>%
  pivot_longer(cols = c(Chla, Chlb, C, Antho, Cellulose, Wax),
               names_to = "Biomarker",
               values_to = "Value")

# Create boxplots comparing biomarkers
ggplot(df_long, aes(x = Group, y = Value, fill = Class)) +
  geom_boxplot() +
  facet_grid(Biomarker ~ Month, scales = "free_y") +
  labs(title = "Comparison of Biomarkers by Group and Class",
       y = "Value", x = "Group") +
  theme_minimal() +
  theme(axis.text.x = element_text(angle = 45, hjust = 1))
```
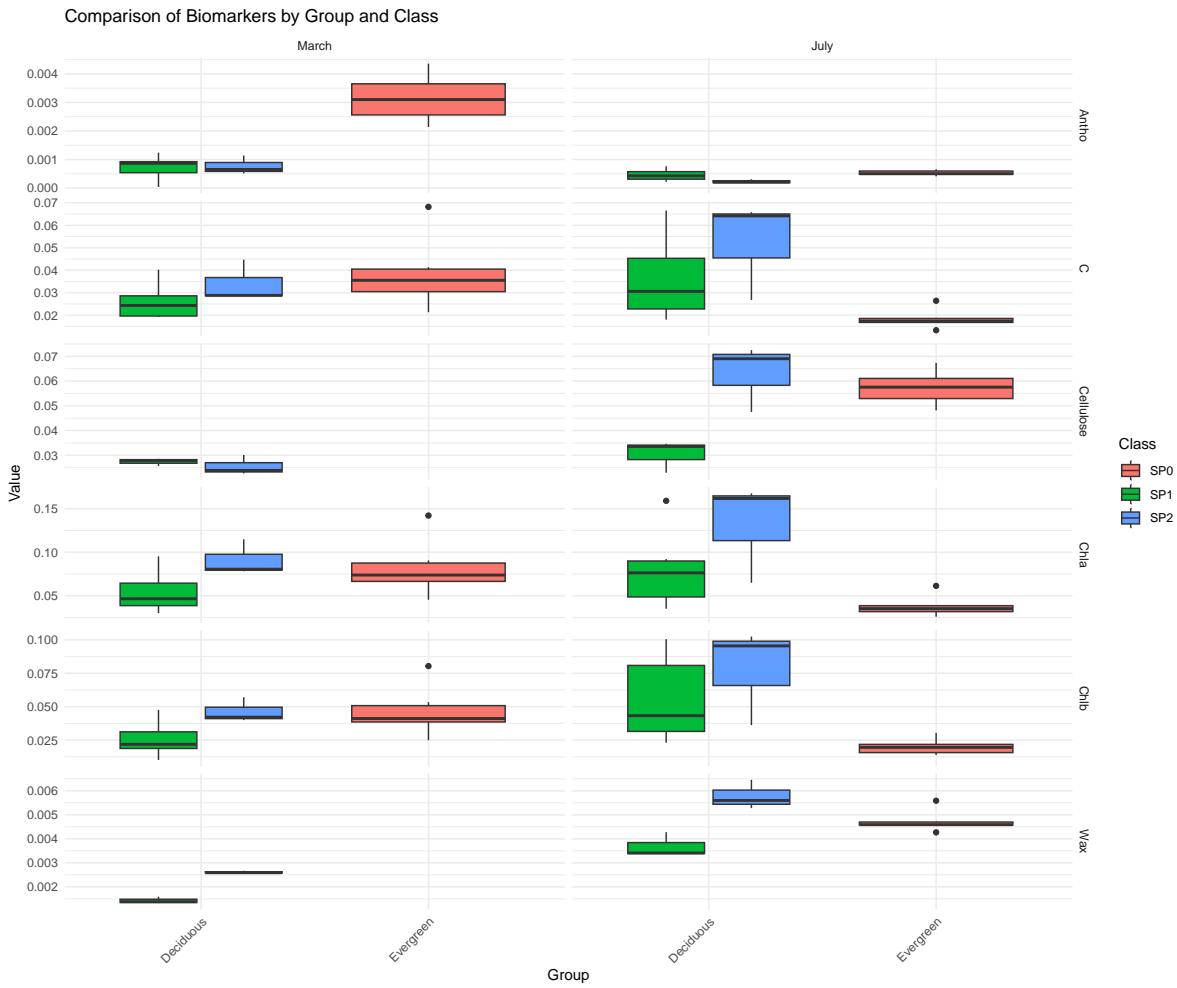
Figure 1: Comparison of biomarkers by group, class, and month

> 💡 **Understanding Biomarkers**
>
> Each biomarker represents different plant physiological processes:
>
> - **Chla/Chlb**: Chlorophyll content (photosynthetic capacity)
> - **C**: Carbon content (structural components)
> - **Antho**: Anthocyanin content (stress response pigments)
> - **Cellulose**: Structural carbohydrates
> - **Wax**: Protective leaf surface compounds

4.2 Statistical Testing

Perform pairwise comparisons to identify significant differences:

```r
# Calculate pairwise comparisons for each month and biomarker
valid_comparisons <- df_long %>%
  group_by(Month, Biomarker) %>%
  filter(!is.na(Value)) %>%
  filter(Class %in% c("SP0", "SP1", "SP2")) %>%
  compare_means(formula = Value ~ Class,
                group.by = c("Month", "Biomarker"),
                method = "t.test",
                p.adjust.method = "none",
                comparisons = list(c("SP0", "SP1"), c("SP0", "SP2"), c("SP1", "SP2")),
                na.rm = TRUE)

# Add position information for significance bars
global_max_y <- max(df_long$Value, na.rm = TRUE)
valid_comparisons <- valid_comparisons %>%
  group_by(Month, Biomarker) %>%
  arrange(p) %>%
  mutate(y.position = global_max_y * 1.05 + (row_number() - 1) * global_max_y * 0.1) %>%
  ungroup()

# Create plot with significance indicators
p <- ggboxplot(df_long, x = "Class", y = "Value", fill = "Class",
               facet.by = c("Month", "Biomarker"),
               short.panel.labs = TRUE,
               add = "jitter",
               palette = "jco") +
  stat_pvalue_manual(valid_comparisons,
                     label = "p.signif",
                     y.position = "y.position",
                     tip.length = 0.01) +
  theme(axis.text.x = element_text(angle = 45, hjust = 1))

print(p)
```
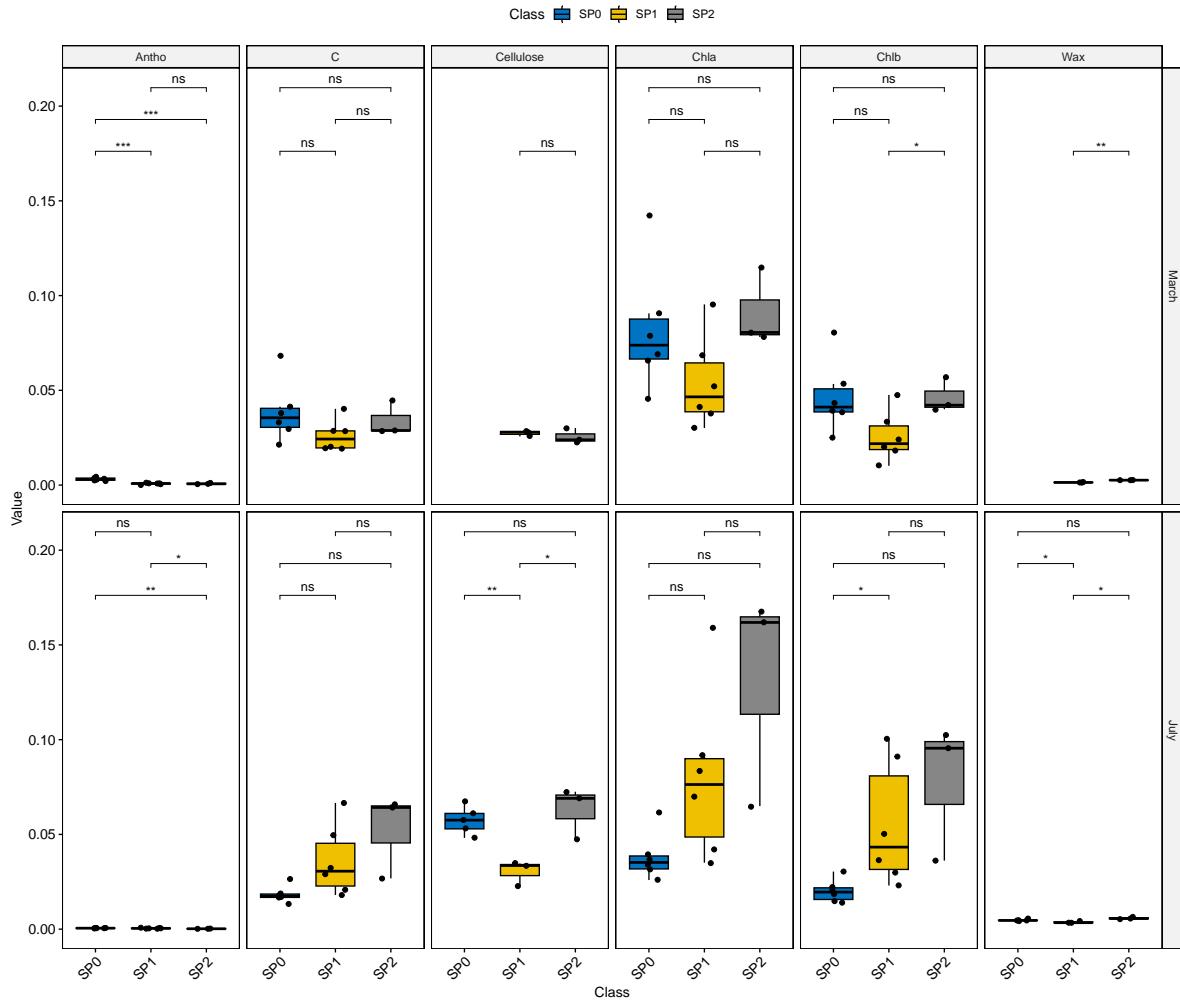
Figure 2: Biomarker comparisons with significance testing

> **i** Statistical Significance
>
> Statistical testing helps identify which differences are statistically significant rather than due to random variation. The significance indicators (, ,) show the strength of evidence against the null hypothesis.

5 Part 3: Spectral Analysis by Biomarker Levels

This section explores how spectral signatures relate to biomarker concentrations.

5.1 Creating High/Low Groups Based on Quantiles

For each biomarker, we'll create a function to analyze spectral differences:

```r
analyze_spectral_by_biomarker <- function(biomarker_name) {
  # Filter data to specific plant groups
  data1 <- subset(data, Group == "Deciduous" | Group == "Evergreen")
  data1 <- data1 %>%
    mutate(Class = as.character(Class),
           Class = str_trim(Class)) %>%
    filter(!is.na(.data[[biomarker_name]]))

  # Group samples by 3rd quantile (top 25% vs. bottom 75%)
  data1 <- data1 %>%
    group_by(Month) %>%
    mutate(q3_val = quantile(.data[[biomarker_name]], 0.75, na.rm = TRUE),
           BioGroup = if_else(.data[[biomarker_name]] >= q3_val, "High", "Low")) %>%
    ungroup()

  # Extract spectral columns
  spectral_cols <- colnames(data1)[str_detect(colnames(data1), "^X\\d{3,4}$")]

  # Reshape to long format
  spectral_long <- data1 %>%
    dplyr::select(Month, BioGroup, all_of(spectral_cols)) %>%
    pivot_longer(cols = all_of(spectral_cols),
                 names_to = "Wavelength",
                 values_to = "Reflectance") %>%
    mutate(Wavelength = as.numeric(str_remove(Wavelength, "^X"))) %>%
    filter(!is.na(Reflectance))

  # Filter to visible and near-infrared range
  spectral_filtered <- spectral_long %>%
    filter(Wavelength >= 400, Wavelength <= 2400)

  # Calculate mean reflectance for each group
  avg_spectral <- spectral_filtered %>%
    group_by(Month, BioGroup, Wavelength) %>%
    summarise(MeanReflectance = mean(Reflectance, na.rm = TRUE), .groups = "drop")

  # Create plot
  ggplot(avg_spectral, aes(x = Wavelength, y = MeanReflectance, color = BioGroup)) +
    geom_line(linewidth = 1) +
```

```
    facet_wrap(~ Month) +
    theme_minimal() +
    labs(title = paste("Spectral Reflectance by", biomarker_name, "Level"),
         x = "Wavelength (nm)",
         y = "Mean Reflectance",
         color = paste(biomarker_name, "Level"))
}
```

5.2 Applying the Analysis to Different Biomarkers

```
# Analyze different biomarkers
biomarkers <- c("Antho", "C", "Chlb", "Chla", "Cellulose", "Wax")

for(biomarker in biomarkers) {
  plot <- analyze_spectral_by_biomarker(biomarker)
  print(plot)
}
```
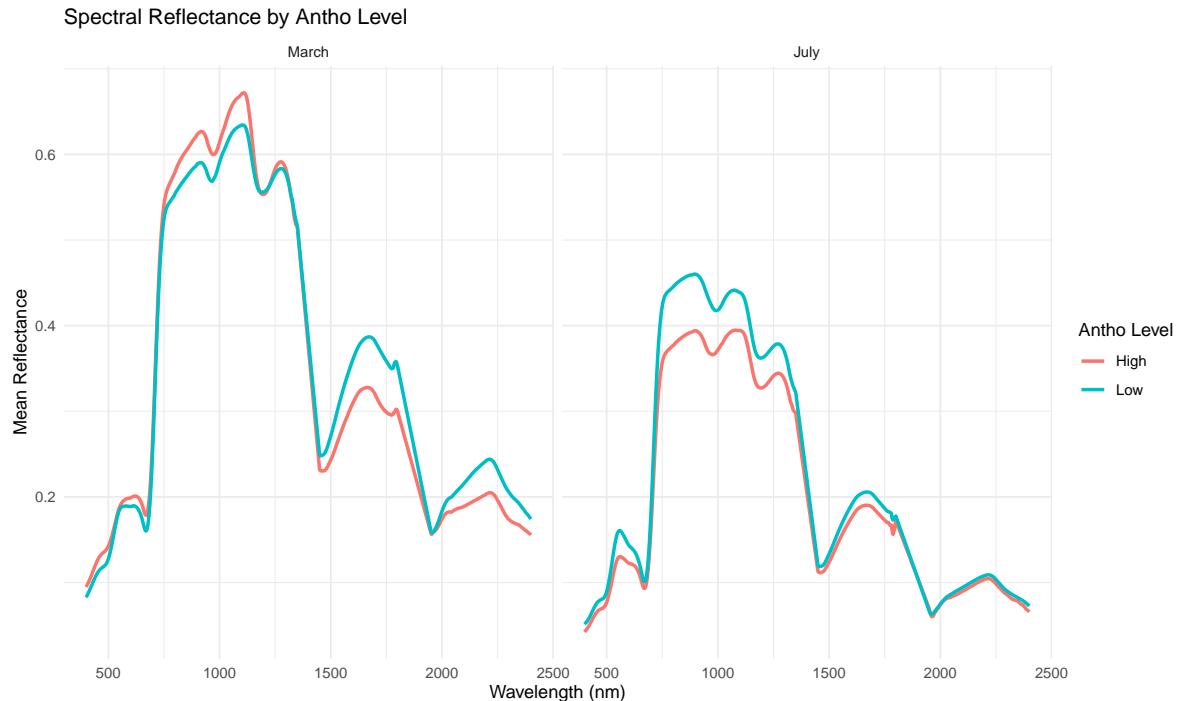

Figure 3: Spectral signatures for different biomarker levels
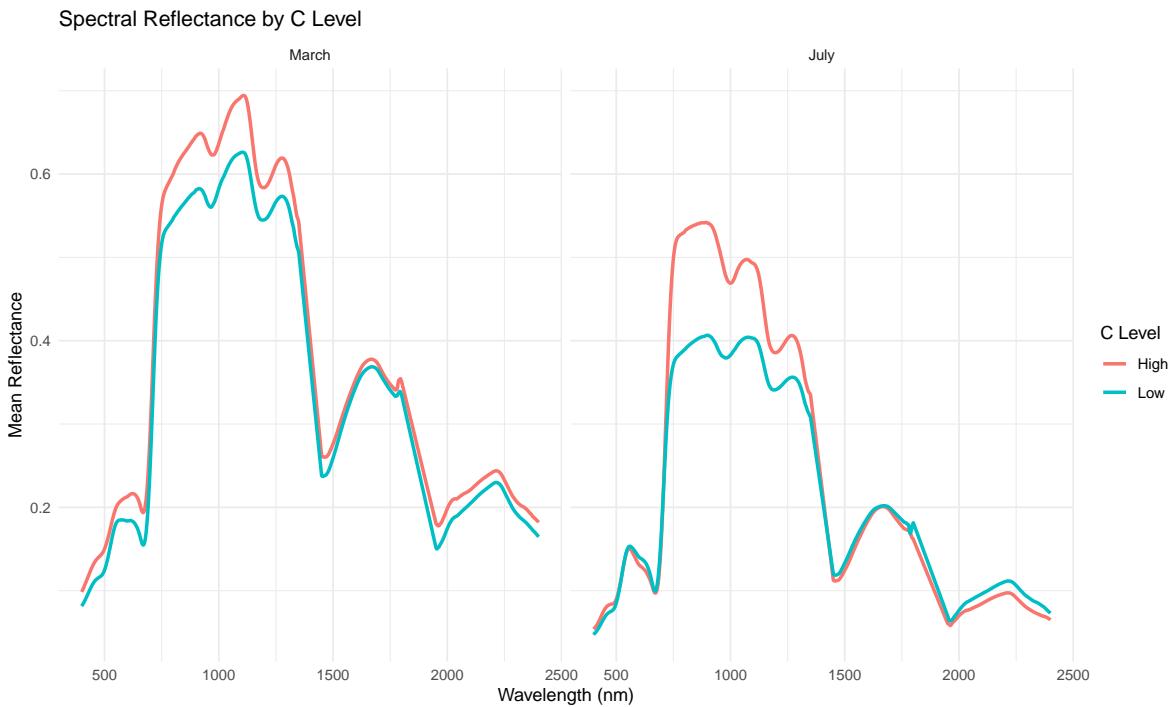
Figure 4: Spectral signatures for different biomarker levels
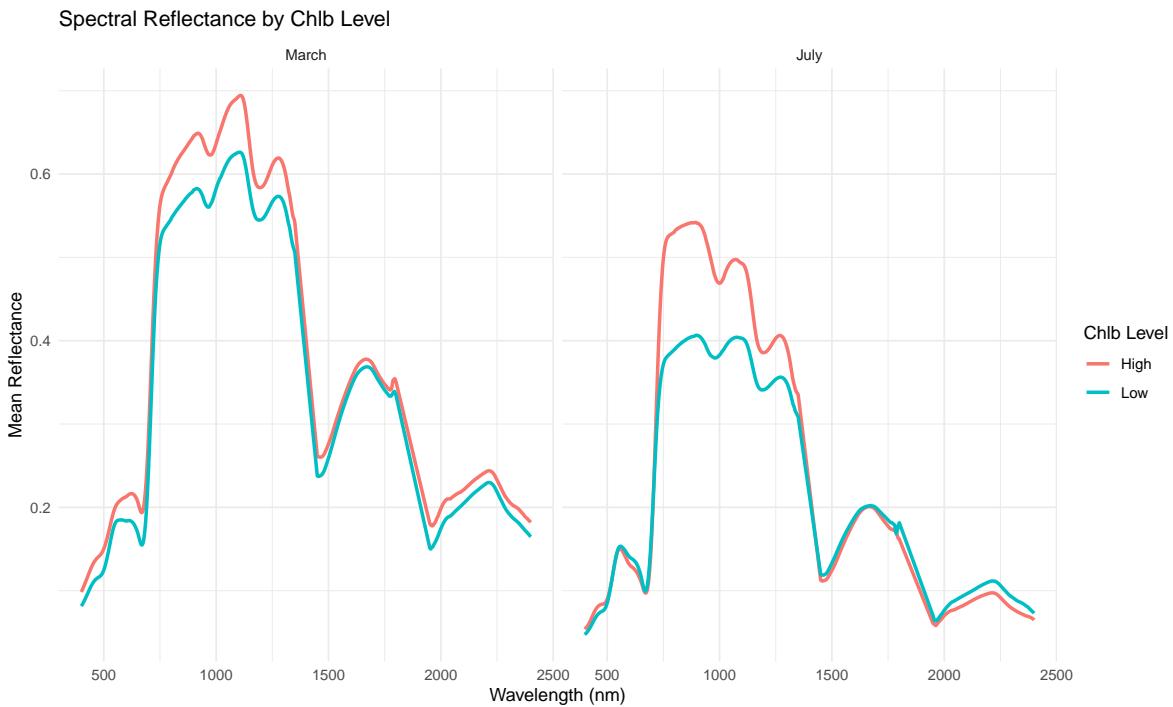
Figure 5: Spectral signatures for different biomarker levels
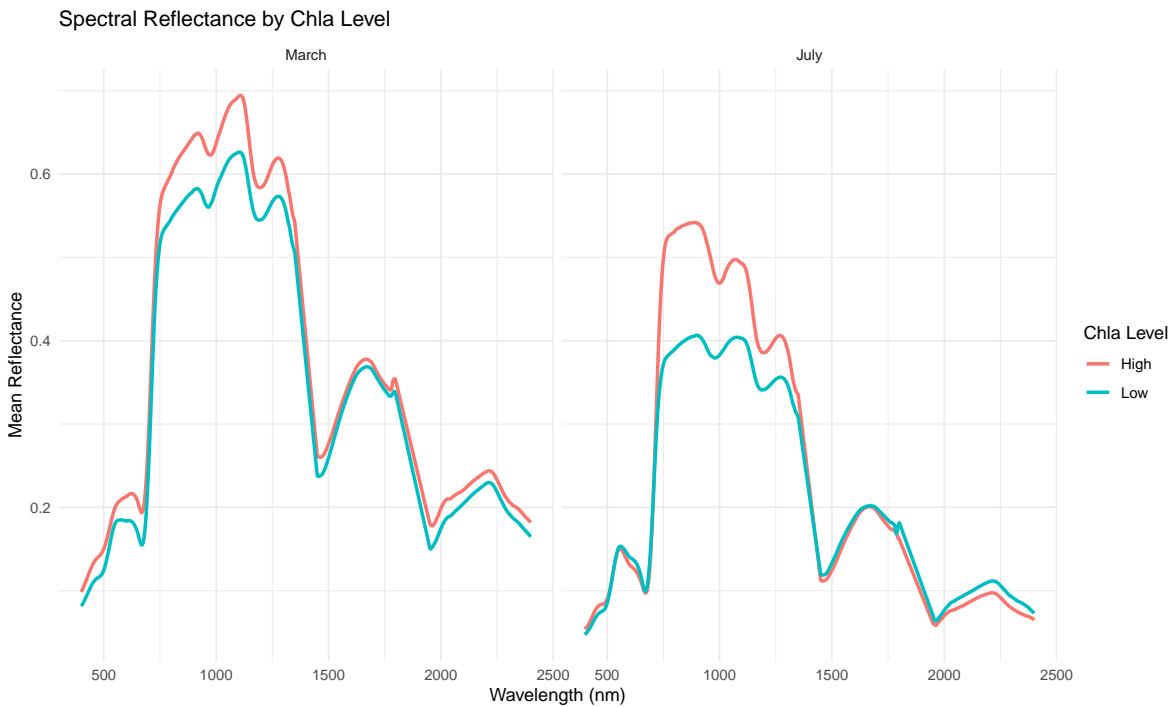
Figure 6: Spectral signatures for different biomarker levels
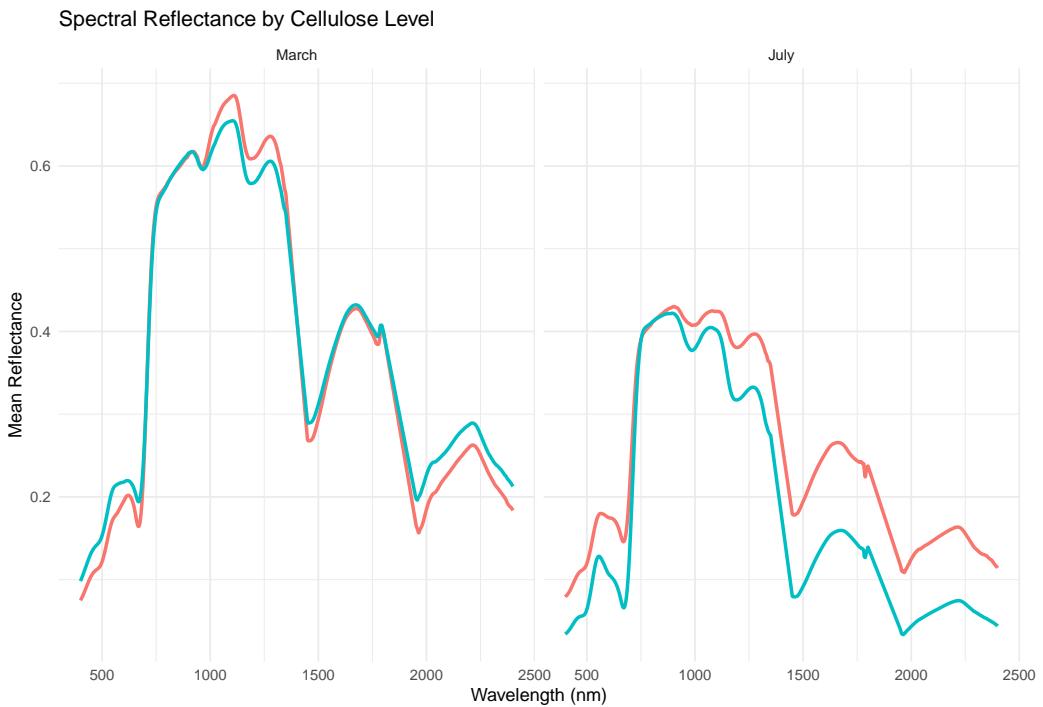
Figure 7: Spectral signatures for different biomarker levels
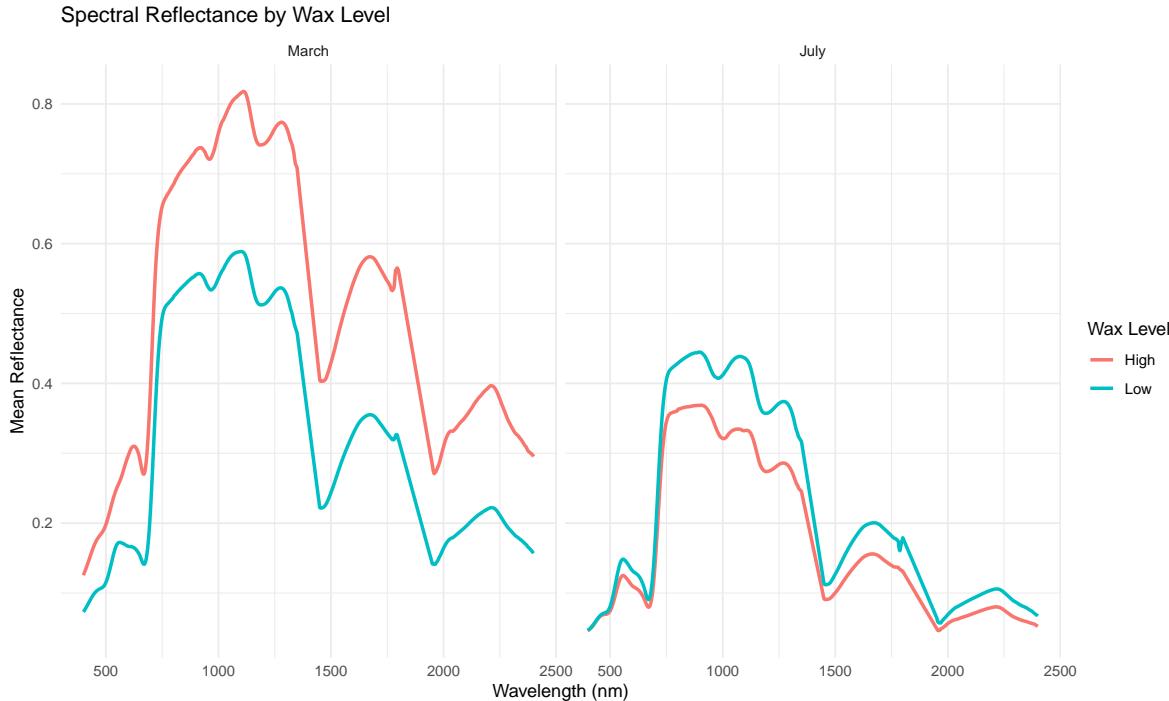
Figure 8: Spectral signatures for different biomarker levels

> 💡 Understanding Spectral Signatures
>
> Different biomarkers create distinct spectral patterns:
>
> - **Chlorophyll**: Strong absorption around 680 nm (red) and 430 nm (blue)
> - **Anthocyanins**: Absorption in green-yellow region (500-600 nm)
>
> - **Cellulose**: Absorption features in near-infrared (1400-1500 nm, 1900-2000 nm)
> - **Wax**: Affects overall reflectance levels, especially in near-infrared

6 Part 4: Machine Learning Classification

6.1 Classification Using Full Spectral Data

We'll use Partial Least Squares Discriminant Analysis (PLS-DA) to classify plant samples based on their spectral signatures.

6.1.1 Data Preparation for Classification

```r
# Prepare classification dataset
spectral_names <- grep("^X\\d{3,4}$", names(data), value = TRUE)
ClassData <- subset(data, select = c("Month", "Group", "Class", spectral_names))

# Scale the spectral data separately for each month
spectral_cols_indices <- which(names(ClassData) %in% spectral_names)
MarchData <- scale(ClassData[1:15, spectral_cols_indices])
JulyData <- scale(ClassData[16:30, spectral_cols_indices])

# Combine scaled data
Class_Data_Scaled <- rbind(MarchData, JulyData)
Class_Data_Scaled <- cbind(ClassData[, 1:3], Class_Data_Scaled)
```

> **!** Why Scale the Data
>
> Scaling ensures that all spectral bands contribute equally to the analysis, preventing
> bands with higher absolute values from dominating the classification.

6.1.2 PLS-DA Function

```r
run_plsda_for_month <- function(data, month) {
  # Subset data for specific month
  df <- subset(data, Month == month)
  df <- df[, !duplicated(names(df))]

  # Extract spectral columns and class labels
  spec_cols <- grep("^X\\d{3,4}$", names(df))
  X <- as.matrix(df[, spec_cols])  # Predictor matrix (spectral data)
  Y <- factor(df$Class)            # Response vector (plant classes)

  # Fit PLS-DA model
  plsda_model <- plsda(X, Y, ncomp = 3)

  # Make predictions
  pred_out <- predict(plsda_model, X)
  pred <- if (is.list(pred_out) && "class" %in% names(pred_out)) {
    pred_out$class$max.dist[, 2]  # Use component 2
```

```r
  } else {
    as.factor(pred_out)
  }

  # Calculate accuracy metrics
  cm <- confusionMatrix(factor(pred, levels = levels(Y)), Y)
  OA <- cm$overall["Accuracy"]      # Overall Accuracy
  Kappa <- cm$overall["Kappa"]      # Cohen's Kappa

  # Create visualization of classification space
  scores_all <- plsda_model$variates$X[, 1:2]  # First two components
  plot_df <- data.frame(scores_all, Class = Y)
  colnames(plot_df)[1:2] <- c("Comp.1", "Comp.2")

  # Generate plot
  p <- ggplot(plot_df, aes(x = Comp.1, y = Comp.2, color = Class)) +
    geom_point(size = 3) +
    geom_mark_ellipse(aes(fill = Class), alpha = 0.2, show.legend = FALSE) +
    theme_minimal() +
    ggtitle(sprintf("%s - OA=%.3f, Kappa=%.3f", month, OA, Kappa)) +
    theme(plot.title = element_text(hjust = 0.5))

  return(list(plot = p, OA = OA, Kappa = Kappa))
}
```

6.1.3 Running Classification Analysis

```r
# Subset data by month
Class_Data_Scaled_M <- subset(Class_Data_Scaled, Month == "March")
Class_Data_Scaled_J <- subset(Class_Data_Scaled, Month == "July")

# Run PLS-DA for each month
march_res <- run_plsda_for_month(Class_Data_Scaled_M, "March")
july_res <- run_plsda_for_month(Class_Data_Scaled_J, "July")

# Display results
combined_plot <- march_res$plot + july_res$plot + plot_layout(ncol = 2)
print(combined_plot)
```
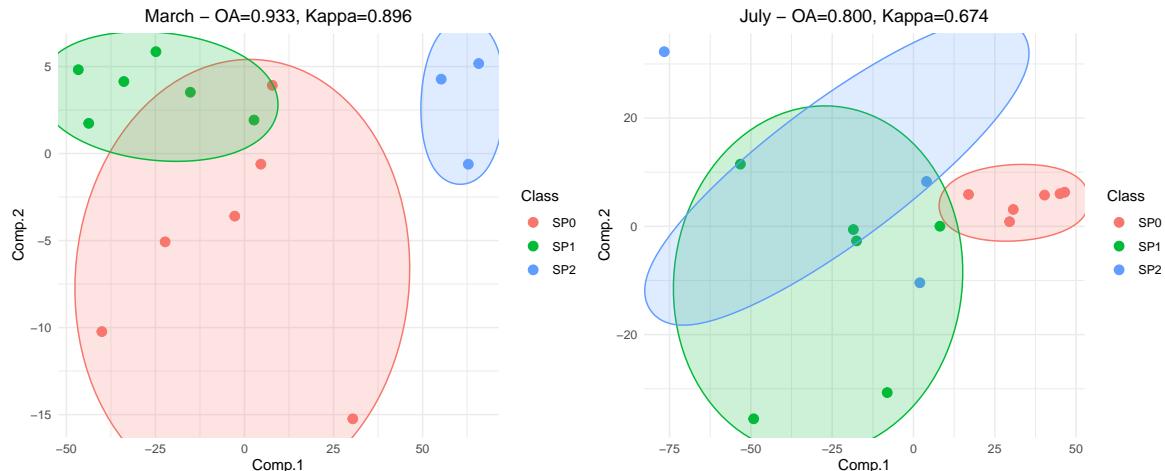
Figure 9: PLS-DA classification results using full spectral data

> **i** Interpreting PLS-DA Results
>
> - **Overall Accuracy (OA)**: Percentage of correctly classified samples
> - **Kappa coefficient**: Agreement between predicted and actual classes, corrected for chance
> - **Scatter plot**: Shows how well classes separate in the reduced dimensional space

6.2 Variable Importance Analysis (VIP Scores)

Identify which spectral bands are most important for classification:

```r
# Function to extract VIP scores
run_plsda_and_get_vip <- function(data, month, ncomp = 3) {
  df <- subset(data, Month == month)
  df <- df[, !duplicated(names(df))]

  spec_cols <- grep("^X\\d{3,4}$", names(df))
  X <- as.matrix(df[, spec_cols])
  Y <- factor(df$Class)

  plsda_model <- mixOmics::plsda(X, Y, ncomp = ncomp)
  vip_scores <- mixOmics::vip(plsda_model)[,1]  # VIP for first component

  return(list(model = plsda_model, VIP = vip_scores))
```

```r
}

# Extract VIP scores for both months
march_VIP <- run_plsda_and_get_vip(Class_Data_Scaled_M, "March")
july_VIP <- run_plsda_and_get_vip(Class_Data_Scaled_J, "July")

# Prepare VIP data for visualization
vip_df <- data.frame(
  Variable = names(march_VIP$VIP),
  March = as.numeric(march_VIP$VIP),
  July = as.numeric(july_VIP$VIP)
)

vip_long <- vip_df %>%
  pivot_longer(cols = c("March", "July"), names_to = "Month", values_to = "VIP")

# Add wavelength information and spectral regions
vip_long$Wavelength <- as.numeric(gsub("X", "", vip_long$Variable))
vip_long$WavelengthGroup <- cut(
  vip_long$Wavelength,
  breaks = c(399, 700, 1300, 2400),
  labels = c("VIS (400-700)", "NIR (701-1300)", "SWIR (1301-2400)")
)

# Create labels for every 100 nm
vip_long$Label <- ifelse(vip_long$Wavelength %% 100 == 0,
                         paste0(vip_long$Wavelength, " nm"), "")

# Order variables by wavelength
ordered_vars <- vip_long %>%
  distinct(Variable, Wavelength) %>%
  arrange(Wavelength) %>%
  pull(Variable)
vip_long$Variable <- factor(vip_long$Variable, levels = ordered_vars)

# Plot VIP scores
vip_plot <- ggplot(vip_long, aes(x = Variable, y = VIP, fill = Month)) +
  geom_bar(stat = "identity", position = position_dodge(width = 0.8), width = 0.7) +
  geom_hline(yintercept = 1, linetype = "dashed", color = "red") +
  theme_minimal() +
  labs(title = "VIP Scores Comparison: March vs July",
       y = "VIP Score", x = NULL, fill = "Month") +
```

```
  scale_x_discrete(labels = vip_long$Label) +
  theme(axis.text.x = element_text(angle = 45, hjust = 1, size = 7)) +
  facet_grid(. ~ WavelengthGroup, scales = "free_x", space = "free_x")

print(vip_plot)
```


Figure 10: Variable Importance in Projection (VIP) scores for spectral bands

> 💡 Understanding VIP Scores
>
> - **VIP > 1**: Important for classification (above red dashed line)
> - **VIP < 1**: Less important
> - Higher VIP scores indicate wavelengths that contribute more to class discrimination

7 Part 5: Classification Using Vegetation Indices

Instead of using all spectral bands, we can create vegetation indices that capture specific plant properties.

7.1 Calculating Vegetation Indices

```r
# Define wavelength ranges for index calculations
cols_750_770 <- paste0("X", 750:770)
cols_490_500 <- paste0("X", 490:500)
cols_660_690 <- paste0("X", 660:690)
cols_690_720 <- paste0("X", 690:720)
cols_760_800 <- paste0("X", 760:800)
cols_510_520 <- paste0("X", 510:520)
cols_690_710 <- paste0("X", 690:710)
cols_530_570 <- paste0("X", 540:560)

# Calculate mean reflectance for each range
mean_750_770 <- rowMeans(data[, cols_750_770], na.rm = TRUE)
mean_490_500 <- rowMeans(data[, cols_490_500], na.rm = TRUE)
mean_660_690 <- rowMeans(data[, cols_660_690], na.rm = TRUE)
mean_690_720 <- rowMeans(data[, cols_690_720], na.rm = TRUE)
mean_760_800 <- rowMeans(data[, cols_760_800], na.rm = TRUE)
mean_510_520 <- rowMeans(data[, cols_510_520], na.rm = TRUE)
mean_690_710 <- rowMeans(data[, cols_690_710], na.rm = TRUE)
mean_530_570 <- rowMeans(data[, cols_530_570], na.rm = TRUE)

# Calculate vegetation indices
VI_Chl <- (1/mean_690_720 - 1/mean_760_800) * mean_760_800      # Chlorophyll index
VI_C <- (1/mean_510_520 - 1/mean_690_710) * mean_760_800        # Carbon index
VI_Antho <- (1/mean_530_570 - 1/mean_690_710) * mean_760_800    # Anthocyanin index
VI_Cell <- with(data, 100 * (0.5 * (X2030 + X2210) - X2100))    # Cellulose index
VI_Wax <- 1 / sqrt(mean_750_770 - mean_490_500 - mean_660_690)  # Wax index

# Add indices to dataset
data$VI_Chl <- VI_Chl
data$VI_C <- VI_C
data$VI_Antho <- VI_Antho
data$VI_Cell <- VI_Cell
data$VI_Wax <- VI_Wax
```

> 💡 **Why Use Vegetation Indices**
>
> These indices are designed to enhance specific plant properties while reducing the effects of:
>
> - Atmospheric conditions
> - Soil background

- Illumination variations
- Noise in individual spectral bands

7.2 Classification Using Indices

```r
# Prepare index-based classification data
ClassData <- subset(data, select = c("Month", "Group", "Class",
                                      "VI_Chl", "VI_C", "VI_Antho", "VI_Cell", "VI_Wax"))

# Scale indices separately for each month
MarchData <- scale(ClassData[1:15, 4:8])
JulyData <- scale(ClassData[16:30, 4:8])
Class_Data_Scaled <- rbind(MarchData, JulyData)
Class_Data_Scaled <- cbind(ClassData[, 1:3], Class_Data_Scaled)

# Modified PLS-DA function for vegetation indices
run_plsda_for_month_indices <- function(data, month) {
  df <- subset(data, Month == month)
  df <- df[, !duplicated(names(df))]

  vi_cols <- grep("^VI_", names(df))
  X <- as.matrix(df[, vi_cols])
  Y <- factor(df$Class)

  plsda_model <- plsda(X, Y, ncomp = 3)

  pred_out <- predict(plsda_model, X)
  pred <- if (is.list(pred_out) && "class" %in% names(pred_out)) {
    pred_out$class$max.dist[, 2]
  } else {
    as.factor(pred_out)
  }

  cm <- confusionMatrix(factor(pred, levels = levels(Y)), Y)
  OA <- cm$overall["Accuracy"]
  Kappa <- cm$overall["Kappa"]

  scores_all <- plsda_model$variates$X[, 1:2]
  plot_df <- data.frame(scores_all, Class = Y)
  colnames(plot_df)[1:2] <- c("Comp.1", "Comp.2")
```

```
  p <- ggplot(plot_df, aes(x = Comp.1, y = Comp.2, color = Class)) +
    geom_point(size = 3) +
    geom_mark_ellipse(aes(fill = Class), alpha = 0.2, show.legend = FALSE) +
    theme_minimal() +
    ggtitle(sprintf("%s - OA=%.3f, Kappa=%.3f", month, OA, Kappa)) +
    theme(plot.title = element_text(hjust = 0.5))

  return(list(plot = p, OA = OA, Kappa = Kappa))
}


# Run classification with indices
Class_Data_Scaled_M <- subset(Class_Data_Scaled, Month == "March")
Class_Data_Scaled_J <- subset(Class_Data_Scaled, Month == "July")

march_res <- run_plsda_for_month_indices(Class_Data_Scaled_M, "March")
july_res <- run_plsda_for_month_indices(Class_Data_Scaled_J, "July")

combined_plot <- march_res$plot + july_res$plot + plot_layout(ncol = 2)
print(combined_plot)
```
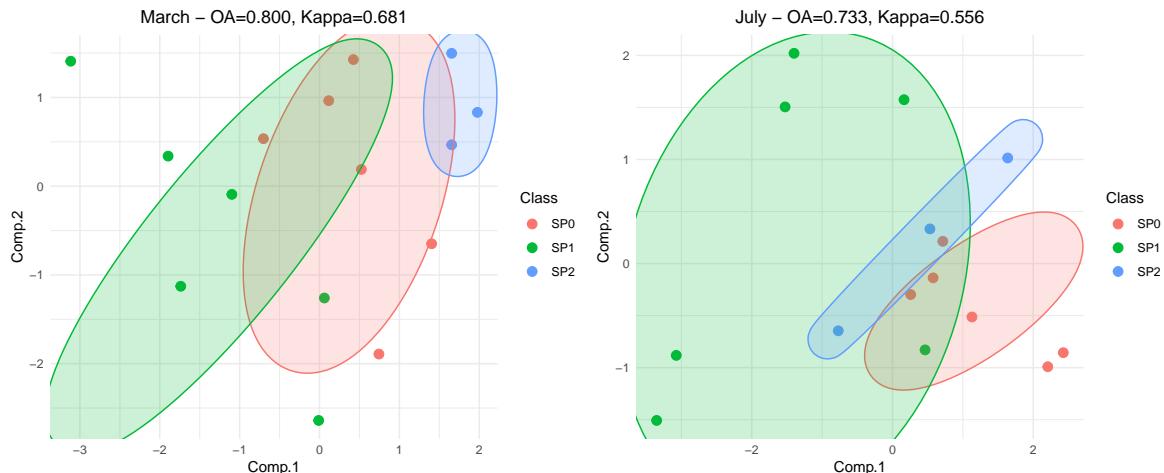

Figure 11: PLS-DA classification results using vegetation indices

7.3 VIP Analysis for Vegetation Indices

```r
# VIP analysis for vegetation indices
run_plsda_and_get_vip_indices <- function(data, month, ncomp = 3) {
  df <- subset(data, Month == month)
  df <- df[, !duplicated(names(df))]

  vi_cols <- grep("^VI_", names(df))
  X <- as.matrix(df[, vi_cols])
  Y <- factor(df$Class)

  plsda_model <- mixOmics::plsda(X, Y, ncomp = ncomp)
  vip_scores <- mixOmics::vip(plsda_model)[,1]

  return(list(model = plsda_model, VIP = vip_scores))
}

# Extract VIP scores
march_VIP <- run_plsda_and_get_vip_indices(Class_Data_Scaled_M, "March")
july_VIP <- run_plsda_and_get_vip_indices(Class_Data_Scaled_J, "July")

# Prepare and plot VIP data
vip_df <- data.frame(
  Variable = names(march_VIP$VIP),
  March = as.numeric(march_VIP$VIP),
  July = as.numeric(july_VIP$VIP)
)

vip_long <- vip_df %>%
  pivot_longer(cols = c("March", "July"), names_to = "Month", values_to = "VIP")

vip_plot <- ggplot(vip_long, aes(x = Variable, y = VIP, fill = Month)) +
  geom_bar(stat = "identity", position = position_dodge(width = 0.8), width = 0.7) +
  geom_hline(yintercept = 1, linetype = "dashed", color = "red") +
  geom_text(aes(label = round(VIP, 2)), position = position_dodge(width = 0.8),
            vjust = -0.5, size = 3) +
  theme_minimal() +
  labs(title = "VIP Scores Comparison: March vs July (Vegetation Indices)",
       y = "VIP Score", x = NULL, fill = "Month") +
  theme(axis.text.x = element_text(angle = 45, hjust = 1))

print(vip_plot)
```
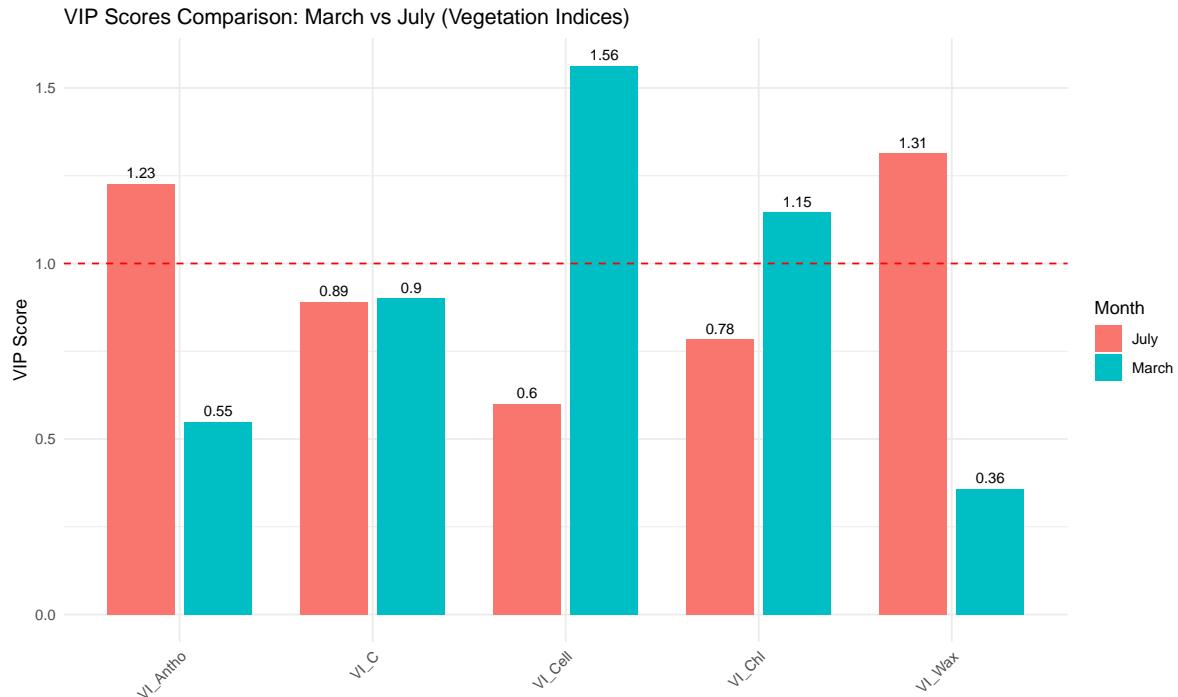
Figure 12: VIP scores for vegetation indices

8 Summary and Key Takeaways

9 Data Preprocessing

- Always scale spectral data before analysis
- Handle missing values appropriately
- Convert categorical variables to factors
- Consider temporal effects when designing analysis

10 Exploratory Analysis

- Visualize biomarker distributions across groups
- Examine spectral signatures for different conditions
- Use statistical tests to identify significant differences
- Look for patterns across different wavelength regions

11 Classification Approaches

Full spectral data: - Pros: More information, captures subtle spectral features - Cons: High dimensionality, potential overfitting, computational complexity

Vegetation indices:
- Pros: Reduced dimensionality, interpretable, robust to noise - Cons: May lose some spectral information, limited to pre-defined indices

12 Model Validation

- Use appropriate cross-validation strategies
- Report multiple accuracy metrics (OA, Kappa)
- Interpret VIP scores to understand important features
- Consider seasonal/temporal variations in model performance

13 Best Practices

- Always validate results across different time periods
- Consider biological relevance when interpreting results
- Use multiple approaches to confirm findings
- Document preprocessing steps for reproducibility

14 Advanced Topics and Extensions

14.1 Cross-Validation Strategies

For more robust model evaluation, implement proper cross-validation:

```r
# Example of k-fold cross-validation for PLS-DA
perform_cv_plsda <- function(data, k_folds = 5) {
  # Prepare data
  spec_cols <- grep("^X\\d{3,4}$", names(data))
  X <- as.matrix(data[, spec_cols])
  Y <- factor(data$Class)

  # Create folds
  folds <- createFolds(Y, k = k_folds, list = TRUE)

  cv_results <- map_dfr(names(folds), function(fold_name) {
```

```r
    test_idx <- folds[[fold_name]]
    train_idx <- setdiff(1:nrow(X), test_idx)

    # Train model
    plsda_model <- plsda(X[train_idx, ], Y[train_idx], ncomp = 3)

    # Predict on test set
    pred <- predict(plsda_model, X[test_idx, ])
    pred_class <- pred$class[, 2]   # Use component 2

    # Calculate metrics
    cm <- confusionMatrix(factor(pred_class, levels = levels(Y)), Y[test_idx])

    tibble(
      fold = fold_name,
      accuracy = cm$overall["Accuracy"],
      kappa = cm$overall["Kappa"]
    )
  })

  return(cv_results)
}

# Example usage (uncomment to run)
# march_data <- subset(Class_Data_Scaled, Month == "March")
# cv_results <- perform_cv_plsda(march_data)
# print(paste("Mean CV Accuracy:", round(mean(cv_results$accuracy), 3)))
```

14.2 Alternative Machine Learning Methods

```r
# Random Forest example
library(randomForest)

run_random_forest <- function(data, month) {
  df <- subset(data, Month == month)
  spec_cols <- grep("^X\\d{3,4}$", names(df))

  X <- df[, spec_cols]
  Y <- factor(df$Class)
```

```r
  # Train Random Forest
  rf_model <- randomForest(x = X, y = Y, ntree = 500, importance = TRUE)

  # Get predictions
  predictions <- predict(rf_model, X)

  # Calculate accuracy
  cm <- confusionMatrix(predictions, Y)

  # Variable importance
  importance_scores <- importance(rf_model, type = 1)

  return(list(
    model = rf_model,
    accuracy = cm$overall["Accuracy"],
    kappa = cm$overall["Kappa"],
    importance = importance_scores
  ))
}

# Support Vector Machine example
library(e1071)

run_svm <- function(data, month) {
  df <- subset(data, Month == month)
  spec_cols <- grep("^X\\d{3,4}$", names(df))

  # Combine features and response
  svm_data <- cbind(df[, spec_cols], Class = factor(df$Class))

  # Train SVM with RBF kernel
  svm_model <- svm(Class ~ ., data = svm_data, kernel = "radial",
                   cost = 1, gamma = 1/ncol(df[, spec_cols]))

  # Get predictions
  predictions <- predict(svm_model, svm_data[, -ncol(svm_data)])

  # Calculate accuracy
  cm <- confusionMatrix(predictions, svm_data$Class)

  return(list(
    model = svm_model,
```

```
    accuracy = cm$overall["Accuracy"],
    kappa = cm$overall["Kappa"]
  ))
}
```

14.3 Feature Selection Techniques

```
# Recursive Feature Elimination
library(caret)

perform_rfe <- function(data, month) {
  df <- subset(data, Month == month)
  spec_cols <- grep("^X\\d{3,4}$", names(df))

  X <- df[, spec_cols]
  Y <- factor(df$Class)

  # Define control for RFE
  control <- rfeControl(
    functions = rfFuncs,  # Random Forest functions
    method = "cv",         # Cross-validation
    number = 5             # 5-fold CV
  )

  # Perform RFE
  rfe_results <- rfe(
    x = X,
    y = Y,
    sizes = c(5, 10, 20, 50, 100),  # Different numbers of features to try
    rfeControl = control
  )

  return(rfe_results)
}

# Correlation-based feature selection
select_features_by_correlation <- function(data, threshold = 0.9) {
  spec_cols <- grep("^X\\d{3,4}$", names(data))
  spectral_data <- data[, spec_cols]
```

```r
  # Calculate correlation matrix
  cor_matrix <- cor(spectral_data, use = "complete.obs")

  # Find highly correlated features
  high_cor <- findCorrelation(cor_matrix, cutoff = threshold)

  # Return indices of features to keep
  keep_features <- setdiff(1:ncol(spectral_data), high_cor)

  return(list(
    keep_indices = keep_features,
    removed_indices = high_cor,
    keep_names = names(spectral_data)[keep_features]
  ))
}
```

14.4 Time Series Analysis

For datasets with temporal components:

```r
# Analyze temporal changes in spectral signatures
analyze_temporal_changes <- function(data) {
  # Calculate spectral differences between months
  march_data <- subset(data, Month == "March")
  july_data <- subset(data, Month == "July")

  spec_cols <- grep("^X\\d{3,4}$", names(data))

  # Calculate mean spectra for each month and class
  temporal_analysis <- data %>%
    select(Month, Class, all_of(spec_cols)) %>%
    pivot_longer(cols = all_of(spec_cols),
                 names_to = "Wavelength",
                 values_to = "Reflectance") %>%
    mutate(Wavelength = as.numeric(str_remove(Wavelength, "^X"))) %>%
    group_by(Month, Class, Wavelength) %>%
    summarise(MeanReflectance = mean(Reflectance, na.rm = TRUE), .groups = "drop") %>%
    pivot_wider(names_from = Month, values_from = MeanReflectance) %>%
    mutate(Difference = July - March,
           PercentChange = (July - March) / March * 100)
```

```
    return(temporal_analysis)
}

# Visualize temporal changes
plot_temporal_changes <- function(temporal_data) {
  ggplot(temporal_data, aes(x = Wavelength, y = Difference, color = Class)) +
    geom_line(linewidth = 1) +
    geom_hline(yintercept = 0, linetype = "dashed", alpha = 0.5) +
    theme_minimal() +
    labs(
      title = "Temporal Changes in Spectral Reflectance (July - March)",
      x = "Wavelength (nm)",
      y = "Reflectance Difference",
      color = "Plant Class"
    ) +
    facet_wrap(~ Class, scales = "free_y")
}
```

14.5 Model Interpretation and Explainability

```
# SHAP values for model interpretation (conceptual example)
library(shapr)

explain_plsda_predictions <- function(model, data, sample_indices = 1:5) {
  # This is a conceptual example - actual implementation would depend on
  # adapting SHAP or LIME for PLS-DA models

  # Extract model components
  loadings <- model$loadings
  scores <- model$scores

  # Calculate contribution of each wavelength to the prediction
  # This is simplified - full implementation would be more complex
  contributions <- map_dfr(sample_indices, function(i) {
    sample_scores <- scores[i, ]
    wavelength_contributions <- abs(loadings[, 1:2] %*% sample_scores[1:2])

    tibble(
      sample = i,
      wavelength = as.numeric(str_remove(names(wavelength_contributions), "^X")),
```

```
      contribution = as.numeric(wavelength_contributions)
    )
  })

  return(contributions)
}

# Plot feature contributions
plot_feature_importance <- function(contributions, top_n = 20) {
  top_features <- contributions %>%
    group_by(wavelength) %>%
    summarise(mean_contribution = mean(abs(contribution)), .groups = "drop") %>%
    arrange(desc(mean_contribution)) %>%
    head(top_n)

  ggplot(top_features, aes(x = reorder(factor(wavelength), mean_contribution),
                           y = mean_contribution)) +
    geom_col(fill = "steelblue") +
    coord_flip() +
    theme_minimal() +
    labs(
      title = paste("Top", top_n, "Most Important Wavelengths"),
      x = "Wavelength (nm)",
      y = "Mean Absolute Contribution"
    )
}
```

14.6 Integration with Remote Sensing Data

```
# Example of applying models to satellite/airborne data
# This would typically involve raster data processing

library(terra)
library(raster)

# Function to apply trained model to raster data
apply_model_to_raster <- function(raster_data, trained_model, band_names) {
  # This is a conceptual example for hyperspectral raster processing

  # Extract values
```

```r
  raster_values <- values(raster_data)

  # Remove NA values
  complete_cases <- complete.cases(raster_values)
  clean_data <- raster_values[complete_cases, ]

  # Ensure column names match training data
  colnames(clean_data) <- band_names

  # Apply preprocessing (scaling) - would need to save scaling parameters from training
  # scaled_data <- scale(clean_data, center = training_means, scale = training_sds)

  # Make predictions
  # predictions <- predict(trained_model, scaled_data)

  # Create output raster
  # output_raster <- raster_data[[1]]  # Use first band as template
  # values(output_raster)[complete_cases] <- predictions

  # return(output_raster)
}

# Validation with ground truth data
validate_remote_sensing_predictions <- function(predictions, ground_truth) {
  # Extract values at ground truth locations
  predicted_values <- extract(predictions, ground_truth[, c("x", "y")])
  actual_values <- ground_truth$class

  # Calculate accuracy metrics
  confusion_matrix <- confusionMatrix(
    factor(predicted_values),
    factor(actual_values)
  )

  return(confusion_matrix)
}
```

14.7 Advanced Visualization Techniques

```r
# 3D visualization of spectral-temporal space
library(plotly)

create_3d_spectral_plot <- function(data) {
  # Prepare data for 3D plotting
  plot_data <- data %>%
    select(Month, Class, contains("X")) %>%
    # Use PCA to reduce to 3 dimensions for visualization
    {
      spec_cols <- grep("^X\\d{3,4}$", names(.))
      pca_result <- prcomp(.[, spec_cols], scale = TRUE)
      cbind(.[, 1:2], as.data.frame(pca_result$x[, 1:3]))
    }

  # Create 3D plot
  plot_ly(plot_data,
          x = ~PC1, y = ~PC2, z = ~PC3,
          color = ~Class, symbol = ~Month,
          type = "scatter3d", mode = "markers") %>%
    layout(
      title = "3D Spectral Space Visualization",
      scene = list(
        xaxis = list(title = "PC1"),
        yaxis = list(title = "PC2"),
        zaxis = list(title = "PC3")
      )
    )
}

# Interactive spectral signature plot
create_interactive_spectra <- function(data) {
  # Prepare long format data
  spec_data <- data %>%
    select(Month, Class, contains("X")) %>%
    pivot_longer(cols = contains("X"), names_to = "Wavelength", values_to = "Reflectance") %>%
    mutate(Wavelength = as.numeric(str_remove(Wavelength, "^X"))) %>%
    group_by(Month, Class, Wavelength) %>%
    summarise(
      MeanReflectance = mean(Reflectance, na.rm = TRUE),
      SD = sd(Reflectance, na.rm = TRUE),
      .groups = "drop"
```

```
  )

# Create interactive plot
p <- ggplot(spec_data, aes(x = Wavelength, y = MeanReflectance,
                           color = Class, linetype = Month)) +
  geom_line(size = 1) +
  geom_ribbon(aes(ymin = MeanReflectance - SD, ymax = MeanReflectance + SD,
                  fill = Class), alpha = 0.2, linetype = 0) +
  theme_minimal() +
  labs(
    title = "Interactive Spectral Signatures",
    x = "Wavelength (nm)",
    y = "Reflectance",
    color = "Plant Class",
    linetype = "Month"
  )

  ggplotly(p, tooltip = c("x", "y", "colour", "linetype"))
}
```

15 Conclusion

This tutorial provides a comprehensive workflow for analyzing hyperspectral data in plant science applications. The methods demonstrated here can be adapted to various remote sensing and precision agriculture applications. The combination of statistical analysis, machine learning, and domain knowledge creates a robust framework for understanding plant spectral properties and their relationship to physiological characteristics.

The integration of multiple analytical approaches—from basic statistical comparisons to advanced machine learning techniques—provides researchers with a complete toolkit for hyperspectral data analysis. The emphasis on both full spectral analysis and vegetation indices demonstrates the trade-offs between detailed spectral information and practical, interpretable measures.

> **i** Next Steps
>
> To further develop your hyperspectral analysis skills:
>
> - **Cross-validation**: Implement robust validation strategies with your own datasets
> - **Alternative algorithms**: Experiment with Random Forest, SVM, or deep learning approaches

- **Feature selection**: Apply dimensionality reduction techniques to optimize model performance
- **Temporal analysis**: Explore how spectral signatures change over time or growing seasons
- **Scale integration**: Connect lab measurements to field and satellite observations
- **Operational applications**: Develop automated pipelines for routine monitoring tasks

16 Additional Resources

- **Spectral libraries**: USGS, ECOSIS for reference spectra
- **Software packages**: `hsdar`, `RStoolbox` for specialized hyperspectral analysis
- **Remote sensing**: Integration with Google Earth Engine or other platforms
- **Field validation**: Best practices for ground-truthing remote sensing predictions

> ⚠️ Important Considerations
>
> When applying these methods to your own data:
>
> - **Sample size**: Ensure adequate samples per class for reliable statistics
> - **Data quality**: Check for instrument calibration and atmospheric corrections
> - **Biological relevance**: Validate that spectral differences align with known plant physiology
>
> - **Temporal effects**: Account for seasonal, phenological, and environmental variations
> - **Scale effects**: Consider how lab results translate to field and landscape scales
> - **Model generalization**: Test models across different sites, sensors, and conditions

---

This tutorial was designed to provide both theoretical understanding and practical implementation guidance for hyperspectral data analysis. The modular structure allows researchers to adapt specific components to their unique research questions and datasets.