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中华人民共和国农业行业标准

NY/T XXXXX—XXXX

芒果品种鉴定MNP标记法

Identification of Mango （Mangifera indica Linn．）Varieties─ MNP marker method

(点击此处添加与国际标准一致性程度的标识)

（本草案完成时间：2021年）

XXXX - XX - XX发布

XXXX - XX - XX实施

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1. 前言

本文件按照GB/T 1.1—2020《标准化工作导则 第1部分：标准化文件的结构和起草规则》的规定起草。

本文件由农业农村部农产品质量安全监管司提出。

本文件由农业农村部热带作物及制品标准化技术委员会归口。

本文件起草单位：中国热带农业科学院热带作物品种资源研究所、江汉大学。

本文件主要起草人：李琼、何云、洪青梅、濮文辉、彭海。

芒果品种鉴定MNP标记法

1. 范围
2. 本文件规定了利用多核苷酸多态性（MNP）标记法进行芒果（*Mangifera indica* Linn.）品种鉴定的原理、试剂或材料、仪器设备、测定步骤、结果分析。
3. 本标准适用于芒果的原始品种鉴定、实质性派生品种鉴定和品种真实性鉴定。
4. 规范性引用文件

下列文件中的内容通过文中的规范性引用而构成本文件必不可少的条款。其中，注日期的引用文件，仅该日期对应的版本适用于本文件；不注日期的引用文件，其最新版本（包括所有的修改单）适用于本文件。

GB/T 3543.1 农作物种子检验规程 总则

NY/T 2440-2013 植物新品种特异性、一致性和稳定性测试指南 芒果

GB/T 6882 分析实验室用水规格和试验方法

1. 术语和定义

下列术语和定义适用于本文件。

3.1

多核苷酸多态性 multiple nucleotide polymorphism，MNP

在基因组水平上由多个核苷酸引起的序列多态性。

3.2

实质性派生品种 essential derived variety，EDV

由原始品种实质性派生，或者由该原始品种的实质性派生品种派生出来的品种，与原始品种有明显区别，除派生引起的性状差异外，在表达由原始品种基因型或基因型组合产生的基本性状方面与原始品种相同。

3.3

变异度 degree of variance

异型株（非典型植物）占总观测植株的百分率。

3.4

平均覆盖倍数 average coverage

比对到标记位点上的测序片段数目与标记位点数目的比值。

3.5

检出的标记位点 detected markers

至少有一个等位基因型有20条及以上测序片段支持的标记位点。

4 原理

利用多重聚合酶链式反应（PCR）和二代高通量测序扩增并检测样品基因组上的MNP标记位点，分析测序数据，获得标记位点的分型结果和鉴定结论。

5 试剂或材料

除非另有规定，仅使用分析纯试剂。

5.1

水：GB/T6682一级。

5.2

多重PCR扩增与文库构建试剂盒。

该试剂盒能采用附录A中所有引物进行多重扩增，且构建的文库能匹配采用的高通量测序仪品牌与型号。

5.3

高通量测序试剂盒。

该试剂盒能匹配所采用的高通量测序仪品牌与型号。

5.4

芒果MNP标记引物：见附录A。

6 仪器设备

6.1

高通量测序仪。

7 测定步骤

7.1 操作要求

样品准备、DNA提取、多重PCR扩增与文库构建、高通量测序在规定的区域按单一方向进行操作且保持实验室通风良好。不同区域的仪器设备应专用。

7.2 取样

7.2.1 样品应为从变异度不高于5%的芒果品种群体中抽取的个体样本混合物。

7.2.2 从芒果品种群体中抽取的个体的数量宜大于30。

7.2.3 样品个体类型宜为幼嫩且新鲜的叶片，也可采用其它能代表当代基因组DNA遗传物质且能提取合格基因组DNA的组织或器官。

7.2.4 从芒果品种群体中的抽样应具有代表性。

7.3 DNA提取

DNA提取方法应保证提取的DNA质量和浓度符合多重PCR扩增的要求，DNA电泳主带明显，无明显降解和RNA残留，提取与纯化的DNA溶液在260 nm与280 nm处的吸光度比值最好介于1.8与2.0之间。

7.4 多重PCR扩增与文库构建

按多重PCR扩增与文库构建试剂盒的说明书进行DNA质控、多重PCR扩增、文库构建与纯化。其中，多重PCR的扩增循环数不高于20个。

7.5 高通量测序

按高通量测序试剂盒和高通量测序仪的操作说明进行高通量测序。

高通量测序的平均覆盖倍数设置为700倍以上，测序长度大于标记引物在参考基因组上的扩增长度。

7.6 测序数据质量控制

数据质量控制如下：

——利用MLMNP品种鉴定软件将样品的测序数据比对到参考基因组的标记位点上，统计第一次检测的标记位点的平均覆盖倍数*C*1；

——当*C*1小于500时，判定样品的测序数据量不足，从7.5或之前的步骤开始重新实验至第一次检测的标记位点的平均覆盖倍数*C*1大于或等于500；

——当*C*1大于或等于500时，进一步计算检出的标记位点的比例，其中，和T分别为样品的检出的标记位点的数目和检测的标记位点的数目；

——当*R*1大于或等于95%时，判定测序数据合格；

——当*R*1小于95%时，判定文库构建可能失败，从7.3或之前的步骤开始重新实验至第二次检测的标记位点的平均覆盖倍数*C*2大于或等于500；

——当*C*2大于或等于500时，进一步计算第一次和第二次共同的检出的标记位点的比例R=，其中，为第一次和第二次共同检出的标记位点的数目，和为第一次和第二次分别检出的标记位点的数目；

——当*R*2大于或等于95%时，判定测序数据合格。

8 结果分析

8.1 结果计算

遗传相似度按式（1）计算

……………………………………………………………（1）

式中：

——待测品种与对照品种的遗传相似度；

——待测品种与对照品种中均检出的但基因型无差异的标记位点的数目；

——待测品种与对照品种中均检出的标记位点的数目。

8.2 结果判定

8.2.1原始品种的鉴定

当对照品种为在待测品种植物新品种权申请日前的所有已知品种时，判定待测品种是否为原始品种。

当待测品种与所有对照品种间的遗传相似度均小于90%时，判定待测品种为原始品种。

8.2.2 实质性派生品种的鉴定

当对照品种为原始品种时，判定待测品种是否为对照品种的实质性派生品种。

当GS小于90%时，判定待测品种不是对照品种的实质性派生品种；

当GS大于或等于90%时，判定待测品种是对照品种的实质性派生品种。

8.2.3 品种真实性鉴定

——当*GS*小于96%时，判定待测品种与对照品种为“不同品种”；

——当*GS*大于或等于96%且小于99%时，判定待测品种与对照品种为“近似品种”；

——当*GS*大于或等于99%时，判定待测品种与对照品种为“极近似品种或相同品种”。

8.2.3.3 对“近似品种”或“极近似品种或相同品种”的样品，可按NY/T 2440-2013进一步进行田间种植鉴定。

附录A  
（规范性附录）  
芒果MNP标记引物

表A.1中提供了654个MNP标记位点对应的引物序列信息。

表A.1 芒果MNP标记引物

| 染色体 | 正向引物（5->3') | 反向引物（5->3') |
| --- | --- | --- |
| chr1 | TGTAGGAAACCTTGTGGAGTTCAAT | AAAAACTTGTACGACTGGAATAGGC |
| chr1 | ATTTTGTGCCAAGGCCATTTAAAAC | GTTACGTTCCATGAAGCATGATCTC |
| chr1 | TCACCTTATGCTGCTTTAACAATCG | CAATATGCTGGAAAGAAGCCCTTAG |
| chr1 | CCAACGCAATACAGCAATTTGAATC | TGCTTGATTGATTTGTAGACATGGG |
| chr1 | TACTAGAGTTGGCATGAGGAAACAA | TTTCTATGAATACGTCCCAGCATCT |
| chr1 | GACTAATCAATGTGGAAGACATGCT | AAAGTCAATTGGAAAACGTTTCAGT |
| chr1 | GCTGTAACCTTCCTTGAGTTTAGTA | TCAACAAATTACTTGCTCTTGGACC |
| chr1 | TTGTGCAATTTGTGTTCCTTGTTTC | ACTGAATTTGCAAACTTCTCAGGAA |
| chr1 | CCTGCTTAGAAGAAATCCCCTTTTT | GATATGAATGCTGTGAAGGAGCTTC |
| chr1 | GTGACATATGATCTTCCTGGCTTTG | GATGCTGACCTTGTTAAATAGCCAA |
| chr1 | TAAAACCAAACAAGAGTGGCAAAGA | AAGCTAGAACAATATATGGCGTTGC |
| chr1 | ATTCTATATTGCTCCAGTCTGCCTT | TGCCACCAAATATTACAACTTTCCC |
| chr1 | TGAATGCCCTGAAAATTCTGACAAA | CATCCATCCCCACAATACTTTCCTA |
| chr1 | GAGCATTTACCATCCAGAAACAACT | GGAAAGTGCAAGAGGTTAGTGAAGA |
| chr1 | TGATGAGGAAGATGATGAGGATGAC | CCAGATTCAATTTCGTCATACTCGT |
| chr1 | AAAATTGTTTCCTTGAATGCCTTGC | TCAGCACAGAGAATTACCATGAAAA |
| chr1 | GGAGGATCCTGAAAGTTTTAGACCA | TCCCACTTAAAGCAATGAAGCAAAT |
| chr1 | AAATGATGCAAAGCCTTCTCTCAAA | AGCTGCAAACTAAGTAGACATACCT |
| chr1 | CCTGGCCCAAGATTAGTAGTGATTA | GTGATTTTTCTGCGTTTGCTTATGG |
| chr1 | TCAAGTTCAATCCAGTGGGTTCATA | AAAGAGCCAATTCCCCCATTTTAAG |
| chr1 | AGTTGGAAGGAAGTTTTATGTCTACA | GGTCATCTGGTGGAAAATCTTCATC |
| chr1 | GGGAAAGACAACACTCTCTACTGAT | GTATGCTCATCAAACACCACATTCT |
| chr1 | ATTTTGTGCCCTTGAATCATGAGTT | GCCTCAAATGTACAAGAAACTGGAA |
| chr1 | GAAGGAAATCCATTGACCATTGACA | ACAATGTGTTACTCCATCCGAAGAT |
| chr1 | GAATGTGTTTGTCCAGGAAGAGAAG | ACAGCTTCCCAGGAAAACAGTAATA |
| chr1 | CAATCTCTTTGGTCTAGACTCTTTACA | AAATGGTTGAGTGTCTCCTATGGTT |
| chr1 | CAGTGCTTATTTTAGAGCTTGGGAG | ACACAGATAACATTGTTGTGCACAT |
| chr1 | AATCAGAGATTAGATGGGTCGCTC | TGGGCGGATAATAAGTTCAAAAAGG |
| chr1 | GTTTCATTCTCCGCAAAGAAAGGTA | GGTTTTCAATTTTGCAGAAGGTTCC |
| chr1 | TGATGAAAATGCCAGAGAATCAAAA | AGTTATGTCACCTTTTGCTCAACTG |
| chr1 | TTTTGAACCATAATTTGAGCAGCCT | GAAATTCTTCTGAAGTCAACCCCAG |
| chr1 | TTCTCCCAGCTTATAGGATCTTTCG | GCAATGACACTAAAGGTTCAAGGTT |
| chr1 | GGAGACAAAATCATCTGCCAAGAAA | ATTAGTGAGGATCAGCTGATGTCAA |
| chr1 | TGTTCTCTTTGCTAATCCAGACAGA | TTGTATCATAAATAGTATGCTCAAGGAG |
| chr1 | GCCCATATGGAGAAGCTGTCTATTA | TTTCTGTGCCTTGGAATAGGAAATG |
| chr1 | GCCATTGGCTTTCACATGATAGTTA | TACCTTGTAGTGCCACAATATTCCA |
| chr1 | GGACAATCTCACTGAACTTTCCTTG | AAATTGTTTGCCTTGACATTTGACG |
| chr1 | ATCCTTAATCTAGGGCATGGAGTTC | AACAGTATCAAGTGGTCATCAGGAA |
| chr1 | CCCTTCTGGTAAGTAATCCTGGAAA | ACGATCAACCTACAGAATCAGTGAT |
| chr1 | TTTTAGCTCGATTGGTATTTCCTGC | AGCCTACAACATTACCTATGGTCTC |
| chr1 | TGCACAAATAATTTTGGCAAGCAAA | CGTTTGTTGTGTTGCTATCTAGACC |
| chr1 | AATAATCGAAGAAGACAACCTGCTG | AAAGTACCAACAGCCTCTGAAACTT |
| chr1 | TGAAATGGCATTGTTTGGTGTTACT | CACCATTAAAGCTAAGCATGAACCA |
| chr1 | ATTCTGAGCTTAAGTTGCGTGATTC | CCTGGGCAATTGCTAGACATAAATT |
| chr1 | TCACACAGCAAACACTGAATCTTAC | GGATAACCAGACCATCTGTGCATTT |
| chr1 | CATTATTTCTTTGGCGAATTCAGGC | TGCGTTTCTTCTCAATCCTAATCAC |
| chr1 | TGCAAAGGAGAATTTCTGAAAGCTT | GTTCAACTACTACATTTTCAGGAGGT |
| chr1 | GCTTTTGTAGCTTCACAAGTTTTCC | CAACAACTTAACCGGTGCAATTC |
| chr2 | AAGATGAAGGAAAAAGATCCAGTCT | TTAATACTGAGCAATGCAAAGCACA |
| chr2 | GAGAGGGTTAGGAAAGAGAGGTTTT | CACATTGTGCAGCATATCTCATCTT |
| chr2 | TTTTGCACAAACAAAGCCTATTGTG | TGGAGTTTTCAACTAAAAGGTCCCT |
| chr2 | GACAGAATCCTGATACTCCAGCAAT | TTCCACTGGCATAATAATCATTGGC |
| chr2 | TTTCACAATCAGCAACAACTACACA | GGCGAGAAGAAGAGAAATGTTCAAA |
| chr2 | AAAAAGTCAAATGCCACCTGTGTAT | ACGTCTTATCTTGAAAACATGTTGGT |
| chr2 | AGAGTCCCCTTAAGAACAACAACAA | ACCTTGTCAAAGCAGATGATTTCTC |
| chr2 | TCAACATCTTCTTCCATTGAAAGCC | ATTTATGGCCTTTGAATCTCGTGAC |
| chr2 | TTTCCCTCTTACCTAGAACCAACTG | AACAGTTATTTGCAGTCACAGCTAG |
| chr2 | ACACTTCATTCAATCTGGTTTCTTCA | ATGACAAACTACTGCTGAGTGTACT |
| chr2 | TCATGCTATTTTAAAACAAGGTGCA | AAGAGTAAAACTGAGTGATGGGAGG |
| chr2 | GAAGGATAAAGGGCATGATTCTGTG | GGCAACCCAGATCACTATTAGACTA |
| chr2 | ACAGTTCCCACATCTCCCTATTTTA | TGTGTTCAGTGTGCCATATTGATTT |
| chr2 | ATTCGAGGAGTAAATGAGTGAGGAG | TGGATAGCAGCCAATACATTTGAAG |
| chr2 | AATTTTAGCATTCAGGAACAGCACA | ATTTGGTTTTTGGTGACTTCTGGTT |
| chr2 | TTGGGATGGTTGTAGGTTCAACATA | CGCTCTCTTTTCACTCCTTTTGATT |
| chr2 | GGAACAAATTCGTCTAGGATTGCAA | TAAAATTGGCACCACTAGAGGAAGT |
| chr2 | GCTAGGGCATTTAGTTTTCATTGGT | TTAATCTCTTCTGTTTGGCTTCACC |
| chr2 | ACTCTGTGTCTCTGTCAAAGTGTTA | TTGAAGGAGAGTCAAGATTGGAGAG |
| chr2 | AACTCTCCAGCAACTCATAAGTGAT | TTCACCACTGGTTCGAATTAACAAG |
| chr2 | ATGCAAGAAAGTCTGAAAGAAAGCA | AGGACATTCTTTTGGAGCAAAAACT |
| chr2 | TGTAGCCACAATAAAAACCAAACGA | AGCCTTACATCAGCTATCCTAACAT |
| chr2 | TATGGGTTTGGGAAGTGATGTTTTG | TTGCTATCACCTCTCCTAGCATAAC |
| chr2 | GTGGTAGCCCGTTCAAATATGAAAT | ACATGTACACTTCTTTTGTAGCTTCA |
| chr2 | CTGTCATAACAGCTTCTTCATGGTG | ACATCATCTTCCTGTAGCAGTTACTT |
| chr2 | ACAGCTATGTTGAACCCAATGAAAT | TCAATCAAAAAGGAGCAAGAAAGGG |
| chr2 | ATGACTGATATTCCTTCTCAGGTCG | GCCTAAAGCAATCTATGTCCACGAT |
| chr2 | TCTGGACAATGCAGTTATGAGTAGG | GTCCTTGTTTCAACTCTTCAAGTGT |
| chr2 | GAGAGTGAACCGTTTTGGAAATCAT | GACTCTTGCAGAAAAGATTGGTCAA |
| chr2 | AAGCTAAGGACTTCTGGTCTTGAAT | TTCCTAAATCCTTACCTAGTGCGAG |
| chr2 | GAGAACCCAAAACTTGACCAACTAG | TTAATCCTCCAATTGGGTTGTTTCC |
| chr2 | ACGATCCACCCTAGAAAATGCATTA | GAGCAATCAGTGACTTCTTCTGAAC |
| chr2 | TACTAGATAAGCCATGTTTGGGACC | TGTTCAGAGTTAAACATTCAGAGGC |
| chr2 | GAACTACACAGTACACATACCACCT | TCATCACTCATCACTTTTGCATCAC |
| chr2 | GCAAGAAATTCATTTCCAGAAAGGC | GTGGCTTCATTATCAAGCATCGTAA |
| chr2 | CATAGCTCAAACTTCTCACTGTTGC | ATTTGCTGTGTCGATAGTAACATCG |
| chr2 | TCTCAAATCTCCAACTTCCTATTCTGT | TCATTCTCCATTTGTTTGTTGGTCT |
| chr2 | CACTTGATGTACTTTCTAGGTTGGC | TACCTACAATATCTGTGCTGGAGAC |
| chr2 | CTCCGCATCTATGATTCATTTCGAG | TTTCACATTCAGATATTGCTGGCTC |
| chr2 | ATGACTTCTACCATGACACTGTTCA | GCTGTATGTCATCCAGTTTGTTTCT |
| chr2 | ATTGACCAACACTTGAAGGACATTC | TCCCCAAATGGCAAGATTATATCCT |
| chr2 | CCATCAGGTGAAAGGATTGCAATTT | GACCATCTTTTGAGTGGTTGCAATA |
| chr3 | TGAAACGGACACTTTGCTTTTACAT | AGTGAGAGATTCAGGCATTATCCAA |
| chr3 | AGGTTGGCTTTGAAGTAGAGACTAG | GGGCTCTATCACACTTTTATGCTTC |
| chr3 | GCCATCTACCCACTTTACAACAGTA | TTCTGTCCGTCGTAAAGTATGTCAT |
| chr3 | ATGTGACAAGAAAGCATATCCAAGC | GCCTTGAACTAGACAGCTATCCTTA |
| chr3 | TAACATGCTTATAAGTCTCTCCGGG | ATCAACTATGTGCTAGACAATCCGA |
| chr3 | AGGAAAGGGATTCTGGTAGGATTTC | AAACAAAATCCAGAAGTCCACTGTG |
| chr3 | ATATGCTCGTTTCTGTGGAAGAGTA | AACTGCAAGCATTCAGTGACATTAT |
| chr3 | TGTATTTGAAAACTTCTGAGGTGCT | TAATTTTTGTGCCATGTGGTCCAAT |
| chr3 | TTGACCATTTCTTCCTTTGACAAGC | CGTGAACAGTTTACCAGTTGATGAA |
| chr3 | TGATGTGTTTGAGTGAGAGTTGTTG | TCCATAATGCTGCCTGTAATGGATA |
| chr3 | GATAGAGGCACAAATTCCCAACATT | AGTTTAGTCCTTGATACTACTGGCT |
| chr3 | TTTACGGTGTGAAGATTTTGTCCTG | TATTGTTGTGGCTGTGAAAAGCATA |
| chr3 | CTTGAAAACACAGAGAAGTCTTGCT | ATGGTCTCACGATAAACACTACCAA |
| chr3 | GGCCAACTTTAGGGATGTCATAATG | AAGCACAGAAGTATCAACTGATCCT |
| chr3 | TAGTCAGTTGGGGATTTGGAATCAT | GTGAAAGATTTTGTGTTCGGTTGTG |
| chr3 | TATCAAGCTTTTGTGTCAGAATGGG | CACAAAAATTGGTCGAAGAAAACCC |
| chr3 | TGATAATTCCAGTTCGTTGCTTCAC | GTCTGCCTGTAGAAGATCAAGGTAT |
| chr3 | GTTCCAGGATCGAAAGACCTCTATT | AGAACATTGTCCCGAATATCAAAGC |
| chr3 | ACATGCTAAAAGTCTCAAGTGATGT | ATGAACACTACATTGGTGCTCCTAT |
| chr3 | GAATGCAGAGAAAGAGTGAATCTGC | ATTCTGATAGCTCTGCAGATGCTTA |
| chr3 | GCAGATTCAAGATCAGCAGAATGAA | TTACTGGCCATCTGGATCATTAACT |
| chr3 | GCAGCCAAACATAGTCTTGATGAAT | GGATGCTTCTTTATGTTGGGAGGTA |
| chr3 | TCTACACCAATGTTCTAACCTCTGG | TGAGCAAGATCCAAATTAACCAAAA |
| chr3 | ATCACCCTAAAATCTAAGCCATGGT | CCCAACCTCATCCATAAATCCATTG |
| chr3 | GACATCTTTCAGAGCACAAGGTATG | AGGATGATAACCTCAAAGAGTTTAATGG |
| chr3 | TTTGATGCTGTGATTGCTTTAGAGG | TGGAAAGCCATTGATCAAATAGC |
| chr3 | ACAGTTAACTTCATGGCAATCACAA | TGTGGAATTCACTAAGCTGCAAAAA |
| chr3 | GGGCAAAGCAATCTCTGATCAATAT | GATATGATGCTGTGATCCACTTTGG |
| chr3 | AATGCCATAATCATCCAAGACACTG | TCAACAAAATGGCTACTAAACCACC |
| chr3 | CTAGTCTCGCTGCTATTGATTTTCG | GAAACTGAATCAGATCACGCTCAAT |
| chr3 | CCTTCCATTTTCCTTTCCATTCCTC | AAGGTTGTTTTGCTGTTCAACAATG |
| chr3 | TTTCAATCTGACTTCTCCACATCCC | ATACCTACAAAGTACAGCATGTGGT |
| chr3 | ACAAACTTCTCCTCTACTTAGGTGT | ATGAAAGAGAGGAGTATGCCAAAGT |
| chr3 | ACTTATGCATGGCAAGTGATAATGG | GTGCATAAACCCAACCACTAATGTA |
| chr3 | TCAGAGTCTAATGAATCAGCTCCTG | CAATGGAAATCCGATATGGTGAAGG |
| chr3 | GGTGCAAGCAATAAAACTTTTTGCT | ACTTCTTGAACAAAGAGTCTTGCAA |
| chr3 | GCTACAACTATAAGAAGGCAAACACA | GATATTATTTCTCTCATTTGAAGATTTCTTTC |
| chr3 | TCAGTGCTGTCTTACATAACTAGCA | GACCAATCCTTGATGCAACTGTTTA |
| chr3 | TCCACATGAAACTCATTAGAGGTGA | TGACTTGGATGTTTTCAACAACTGT |
| chr3 | GTCACTCCCAAAAATAAAGGATAGCA | GATTAATGTGTGAACCAGCTAAGCA |
| chr3 | CTTTACTGTTGTGTCCCCTGTTTTT | TCCCCAACCTTCAAAATGTTCTCTA |
| chr3 | CATAAACATTACGGTCCTTGTTGGA | ATTCCAACTTCTCTAAAAGGTACGC |
| chr3 | CTGTCCCAGATTCTTGTGGTTTTAC | CACTGTCTGCTAATAAAACCTGCAA |
| chr3 | TTCCCTTCATGTTCACCAAGTTCTA | AACAAATCAACCTCTGGAACAAAGG |
| chr3 | GTGATCTCTCAAGGAATCAATGCAG | AGCTTCGCAGATTTTATCGACTTTT |
| chr3 | CTTAGCAATGGTCTTTTCTGAACCA | TACATCAAATGTGAAGCAATGGTGG |
| chr3 | ATGACAAAACCATTCACATGCTCAT | AAGGGTGGAAAACAATTCTAAGCTG |
| chr3 | CAGCAGTATCCTTAGGTTCAGTCAT | ATCACCTTCCAGCAATGAACATTTT |
| chr3 | TATCGTAAAGTCCTCACCTGATTGG | TGCCATCATGGAGAAAATATTGCAA |
| chr3 | CGATACAATTGCTTGATTCCTCCTC | GAGGAATGTTTGCCTTCCATACTTT |
| chr4 | GAGCTGATGAGAAAGTTGCTAGAGT | ACATATATAGGCTTCTGTGACAGCC |
| chr4 | CCCAGTAAAAGAAAAAGGGCAAAGA | TGCATTATTTTCCTGATAGCTGCAG |
| chr4 | TTGTCCCATTCCATGAGATTGAGAT | TGAACAGGTAAGATGATTTAGATGACT |
| chr4 | GCTGGAAGCACACAACAAATGAATA | TGCCCATGTGGTTGTGTTATTTTTA |
| chr4 | GAAGCGAATTCTCATCCAAACTGAA | TATTCTAATCTGTTGGAGCTTGCCT |
| chr4 | TTAGAACACTTGTTGCCAACACTTT | TTCATGGTGTAGGCCATAACACAAA |
| chr4 | ATATCTCCTGGTAGATGAACCCAAG | AGACAACAAAGAAGATGGCGATTAC |
| chr4 | GGTATGTACTCTGTGAACTCTCCTC | ACAGAAGGTGTAATGATGACTGGAA |
| chr4 | TGTACATACTCAGTAATGGCAGCAG | CGTTTGAGTCATCCGGTTTTCATAT |
| chr4 | AAAACACTCTCCACCATTAGATCCA | TGGGTTTGTCACTTTTGATGAGAAA |
| chr4 | TGAACAAAAGAATAGATAAACCCACA | ACAAATGCTCTCTAAGTAACAATACCT |
| chr4 | CTGAATTGCATCCTTCCAAGAAAGT | CTTCAACACGATTATAGGAAGTGGC |
| chr4 | AACCTGCTGAGACTTACTGTGTTAT | TCTGAACTTAAAGCAGCTTCTTACA |
| chr4 | GGAACCTTATGAGCCAAACAAGTC | TGGCCTTAACAATCTTTTCCACAAA |
| chr4 | CCAATGACCAAAACCTCATCAATCA | GATCCGTTGTCTTTTAGAAACTGCA |
| chr4 | CTCTGTATCAAAACGCGATTCTCAT | GACTGGGAGAGTAAAAAGGGAAGAA |
| chr4 | CGGATCCAGGATCAGTGATTCTTAT | TTATTGAGAATTTCCGATCCACAGC |
| chr4 | AGCAGATGATGATTTGCCTAGTGTA | TCATGATAAATCAAAAGATCCCTGCC |
| chr4 | GTATGAAAAGTACCCAAAAGGCCAA | CCACAAAATTAACCTCTTTCCCCAA |
| chr4 | TGGAAAGAGGAGAAAAGCTACTTGA | TTCAAGTTTAACAACATTATGCGCG |
| chr4 | TCAGATTCATCAGAGCCCTGTAATT | GACACTTGGCAATCTGAATTTGGTA |
| chr4 | CTTCATGGTCTTTGTGTTGATTCCA | ACCCTTCAAACATTTCATGTCACAA |
| chr4 | TCATCCTCGTGCTTCTCATTCTTAT | TACCAAGTCAAGCATTCCCATGATA |
| chr4 | ATTAAGGCCAAGATTCTTAGCTGGA | AACTGATTGATGCCTTTATGCACAA |
| chr4 | TGGTTCTGAAGTTTCCTTATGCCTT | GCTCAAAGAAAGGGTAGTCCAAGTA |
| chr4 | GTTATGCGATTGCCTTGATCGTTTG | ACTTATATTCGTCCGTTGAGTTCGA |
| chr4 | CCATTGGTGATGCTTGTTCTTCTTA | CACCAGAAAATGAAACTAAGGGACC |
| chr4 | TCATTGAATCATATAATATTCATTTAACAATCCA | GAAGACTTTCCAACGTAACAAAGGT |
| chr4 | GTTCGTTTGTCTCTTGATGATCCTG | AATCCAGCAAGCCAAATTCATGTTA |
| chr4 | TTGGTTTTGAGATCCATGAAGTTGG | TTTTGATGTCAAGATCCCAAAGCTC |
| chr4 | CTGCATACTAACATGATCTTGTGCA | GCAGTTGGGGTCATATCTTCTATCT |
| chr4 | AAACAGCTGTTTGATGTGTTTTTGG | TCATATCCATAATGTGACATGGCCT |
| chr4 | TGACACTGGAATTTATCACCAGACT | AGATTTCCATTGCTTCTGTCACAAG |
| chr4 | CCTGTGCTTCTGAAACTACTGTAAG | ATACAAACACAACCTACAAGCATGA |
| chr4 | TTTATAGCAGAGATCGGGTTAGCAA | TATGCTTGGTCAACTCACTCTAACA |
| chr4 | ACAGCTTGGTCATTTATTTCCATCC | TGGCATTGATGGATTGTACTTGTTT |
| chr4 | GGTGGTGCAAGTCTTTCAGAATTTA | TATCCTCCACTATTATGATGCCTGG |
| chr4 | AGTGAGATGATAACATAGACGCCTG | TGTTTTATTCTGAAGACTGTACGCG |
| chr4 | CGGAATTTTGAGAGGAGGTTCAATT | ATTGCCAATGAGCTGAGAAATTTGA |
| chr4 | TGTATACTCCTGGCTATTATGGTGC | GCAAGGCAAACAAACTTTTCATCTT |
| chr4 | CACCGCACTTCAATTATCACCAATA | ACTTGTTTGGTTTTAGTGCATAGTCT |
| chr4 | AGTTTGGCATGGATTCACTTATGTT | GATATCTCCAGCAACTTGTCATTGG |
| chr4 | TCATCATCTTAGCCTGATCACTGTT | GGAATGCGACATATTGAAAGGTCAT |
| chr4 | CGTTTCACAGCCCTTGAGAAAATAT | AAAAGTGGCTAGTAGATGTACGAGG |
| chr5 | CAAAACAAAGTCTTCATCACAACGC | TCTGAGCTAAAAATTTTTGAACTAAACTT |
| chr5 | AGTGGTGCTCTTACTAATAGAGGAC | ATAACCCAACAAGGCAAATTCCAAT |
| chr5 | GTGCTCATTGGAAGAGGATACATTG | GCTAGGAAGCCCAAGGAGAATAATG |
| chr5 | GCCACCAAAAAGGAATAAGATGCTT | TCCCTTGGTCATTTTGCTCATAAAC |
| chr5 | TCACCTTCGAGAGTTATATGACACA | AAATTTCAACACTAGGTCAATGGCT |
| chr5 | TCTTTGCTTGAAGGTTTGTTGCTAA | AGGGTTCGATTGTTTCTATCCTCTA |
| chr5 | CCAACATCTCTTTGACGGAATTTCA | TAGGACACACATACACGTTGTTACT |
| chr5 | GACAAAACAAAGCCCATCCTTGATC | GATGCTATACGTTGGGAAGAACAAC |
| chr5 | ATTCACAAGAGAAGGAGAAGGGTTT | TCTATGACTGCCCTTAAAATTGGTG |
| chr5 | TGAGAAGAACCTATGGCCTAAACAA | TTTTTCTCCTTTCTCTCTCAGACCC |
| chr5 | TCAGTTAAGCGTTGAGTTGTTTACA | GCTGAAGAAGTATGTTGTGCATTCT |
| chr5 | AAGATAGGTGTTTGTGTGATCTCCA | GGAAGTGACTTAGTTTGCAACTCTC |
| chr5 | ACTTTGCTGCCATAAATTGATGACA | AAGGCTTGTGTTGAAGTTCATATGG |
| chr5 | GCTCACAAAGGAAAAATCAGATAACG | CAAAGGACAAAGAAGGTGATGGAAA |
| chr5 | CTGGACAGCAAAACAATGTAAAAGC | CCTGTAAAAGTTGGCCACCTTAAAT |
| chr5 | CTGGTTCTTCTCTGTTGCTCAAAAA | AAGTCTTTAGGGAGGCGTTTAAGAA |
| chr5 | CAAGCTGCTTTTCAAGTGATTCAAG | CAGCAGGAATATCTGAAGCTGAAAG |
| chr5 | CTTACCATCTCTGAATTGGTGATGC | TTATGGGACTCAAAAACAAGTGCTC |
| chr5 | TCCTGTGTGCCTATATTAACCACTG | TTGAAGTTGCTAAAGATGGTGTTCT |
| chr5 | CTGCATAAGATTTGCAGATATGGGG | CGTCTCCTTTCTTCAGTCTGTCATA |
| chr5 | CACCATTAAAAGCACTAGAACCCTG | ATGATTCAAACACTGGTTCTGTTCC |
| chr5 | ACTTGTTATTCTAGCCTTGGCTTTG | TTTTGTGCCACATTGGGAAAAGATA |
| chr5 | TAATTTGGAACTTCTTTGCCCCAAG | GCGAAGTTGGTCAATAAAAATGCAA |
| chr5 | AAGGTTGTTATCCCATCTTGGATCA | ACTTATCCCCATATTCCACATGAGG |
| chr5 | GATAGACAGGTTGCCCTTGAAAATT | GCCTATACTTCAACTCAATTTAGGCC |
| chr5 | CACAAGAGGGGCCATTCAAATATAC | AACTTGGTGAGAAAGTCGAAACATC |
| chr5 | ATGTGAACTCCATGAAAAAGCACAT | GCCGACAAAGAATGATATTCCGAAT |
| chr5 | TTCATTTCAATAGCTTTTTCCAGCA | CTAAAACTGATACTGTTTCCGGAGC |
| chr5 | CAGGGGAGACTTTTCTGTATTGGTA | TGTGTCTGACCCAATCTAATCCATT |
| chr5 | TGGACATTAATAAAGACATACCAAACA | TGGGGAAGGTGACTAAATGATTCAA |
| chr5 | GCTTCTGCAGCCATATTTGATGTTA | ACAACAGGCACAACCATTGATTTAA |
| chr5 | GCAAACTCATAATCCACAGCAAAAC | CTGTTAAGGTGGTGGAATTTGAACT |
| chr5 | GTTGATGCTACTTGAAATCCACCAC | CAAGAATGTGATGCCATTCTCCTTT |
| chr5 | CAAACCGTCAAGTTACAGACATGAT | GCAGAAAATGGATTGCAATATGTGTT |
| chr5 | ATAATACCTGGCTAAGTCTTCGGAG | GGAGGTTCTTGAGGGGAAGATATTC |
| chr6 | AACTCAAGGTGCAAAGGAGATTAAA | AATCAATCCCACTCAAGCAAGTAAC |
| chr6 | TATCGCTGCCAGAAAACATGTTATC | TTGGTGGCACTGGCATTTATTTAAA |
| chr6 | CTTCCAACTCAAGTTTCTTCCTTCA | TTCAATATACCAGGCATCAGAGTGG |
| chr6 | CAACCAAAATTCTCAAAGTCGCATC | GCTCACTAACCATACAACAACTAGC |
| chr6 | GTTTTTGCCAAAGCTCAGAACAATT | ATGGCATTGTACTATGTCTTCTGGT |
| chr6 | CAAGTGGATAATTTGGACAGATGGC | CATTAAGCACAATTGAACTGCCTTT |
| chr6 | GACACTGAGGCTAGTACTTATGTCA | TGACTTCATTGAAGGACATTGCTAC |
| chr6 | AAATATGCTTTCAAGAGTACCTGGC | AATTATGTCCAGGTTTCAGAGAGGG |
| chr6 | TTGAAGATCTGATTGCCTAGAATGG | AGGTTAAGGTTGAAGAGAAGGAGAC |
| chr6 | GAGCCAAAAACATCTACTTCAACCA | GCTCAATTAGATTGCTAGCTCCATC |
| chr6 | TCTAAAGGTCAGAATGAAGCTTCGA | AGCAAGGGAGAAGGAATAAAATGGA |
| chr6 | TCTATAACTTCTCTAGAGTGTGTGC | GGGACAAATCATTACCTTACCGTTC |
| chr6 | CAAGTTGGTCACCTTGGTTCATATA | AAGGCACTCAAATAGTTTCTTGACC |
| chr6 | TCACTTATCTTGCCACTTACGTACA | GCAAGGATGAAGAATGACCATGTAT |
| chr6 | CGACAAGGGCATATGTAAACAACTT | TAGCACTATCTGGGGCTCTATTTTC |
| chr6 | GGACAAGGACAGATATGATAAGGCT | TCTTACATTGAATAGAGTTGCAGCG |
| chr6 | CCCAAGGACAAGTTTCCTAAGTTTC | AACATTTCAGATCTCGAGTCAGAGT |
| chr6 | GGCATAGTAATTGATTCCTTGAGGT | GATATCATGCATTTCACCAAGCTCA |
| chr6 | TGTATTGTGGAATGTCAAACCCATG | TTTATTGCACGAGTAATGGAAGCTC |
| chr6 | CCCTACAGAGACTAAGGGTTATAAGG | TACTTTGACTCTGACTCTGTGATGG |
| chr6 | AGTTCCATAGGCATGAGTTAGTTGT | GTCAACCAAGAATTTCCATTCACCA |
| chr6 | TACAGAAAATGTGATGGTACCTGGT | AAACATTTGCAGTGACATAGCTGAA |
| chr6 | TAAACTAAAACAAACAGACCGACAA | TTACTTTGATCTGATTTCTGCCGTG |
| chr6 | ACCAGTTAGCTAGAGACTTAAAGGC | ACAACGTTATGGTTCACACTGAAAT |
| chr6 | TGCTTACTCTTTTGTTTTTGATTGCT | GACCACAAGTCTGAGTGAACAATTC |
| chr6 | CCGCACAAATGAAAATGGAAAACTT | TATTTAGAACAGGAAGCTCAAGGGG |
| chr6 | TTCACCAAGTCCATTTTGAGCATAC | ATTGGCTAATGACCCGAAGCATATA |
| chr6 | GCAACAAATTGTTTCAACTTCAGCA | GTTGACTCAGTGGTGAATGCAATTA |
| chr6 | TTTTCGTGATATCGATGACCGTACA | TAATATATAGCATCTGCAAGGGGCT |
| chr6 | CAGTGAAGGACGTTGGGAAAATTAA | ATGCAGAATTTCTAGACAAAGTGGG |
| chr6 | GACTCACCATTTTCTCACATTCCAT | AAAGAATGGGTTTGAGAAAGAGCAG |
| chr7 | AGAATGTCATATTTCGCAGTTGCTT | CATGACTTGTTAGAATGCTGATCCC |
| chr7 | GGTCACTGATCTTGCAAAAGTTGTA | TGCTGAAATTAAAGAAACAGTACCTCC |
| chr7 | AACAAAACTTAGTATCACACCCTGG | ATCTCTTCCAAATTTAATGCCACGG |
| chr7 | TGGAAGTGGAATTGTTATGATGCTT | ATTGTAGAAAATCGCATACTCCAGA |
| chr7 | CATCGGCAACAAGTTTCTTCAATTG | TCTGAATTTCACGTGTGCGATTTTA |
| chr7 | TAATCCTCTACAACTTTCTTGACGC | GTTTTGCACCCACTTCATAACAATG |
| chr7 | ATCTTCAGAGTTCCAACCGAAAGTA | AATTTCCTCCATGTTCTAAGGGACA |
| chr7 | TCTATGAATTTTAATGCTGCCAGGC | TCAACTAAAGATTAAAGGGGCCTGA |
| chr7 | TCAATTGGTAAGTGAATGTTGGGAT | GATAAATTCACCCTTCGCAAGTTGA |
| chr7 | TTGCTACAAGTTGTTCTAAGGGTCT | TCAGCAAGAAAATCAAGGCAAATCT |
| chr7 | TCTCTACTTCCACAAAAAGCTCAGA | ATCTCCTAATCTCAATACCCTTGCC |
| chr7 | AGCATTTTCAGAGCTGTTACTCCTA | CTATTGAAGGCGTAAGAAGCATGAG |
| chr7 | AGAGTTGGACAATTTGGTAGTCGTA | ACATTAATTCATACAAGGCACCCTC |
| chr7 | TCCTTTCTGAGAGTAGCATATGAGC | TTGGGACCTATTAAGCAACCTTCAT |
| chr7 | ACGGAGAACTAGTAAAACTTGAGGT | GGGTGGGAAGCTTGAGAAATAAAAA |
| chr7 | ATCATCAGGTCAAAGGCAATTGTTT | TAGTCCACCTCTTACTATATCCCCC |
| chr7 | TCACAGCAAACGAGCTTTTAATCTT | GACTTTCTCTGCAGCAAACAAGTAA |
| chr7 | AGCACTTTATCTAGCCAACTTAGGG | CCTTTTGGGATTGTTCTGTTGACAC |
| chr7 | ATGGGAATTTCTAAACATGGAAGCC | CTCTCCAGTTCTTCCCATGTTTTTC |
| chr7 | CTCCCCTGTTACAATTTGCATTGAT | TACGGCGTTGATCCTATAGATGAAA |
| chr7 | AAAAACAACTGGACTAACGAGAAGG | ACCACAAAACATCTTAATGACTGACA |
| chr7 | CTCGTTTGGCCATTTGCAATTTC | TCCAAATCCACAGACATTGAATTCC |
| chr7 | AGTAGATATAGGGGGCTCAGATTCA | GTAATGAGGCTGTGACGAATGTTTC |
| chr7 | ATAGAGTGCCAACCTCTTTGTATCA | AGGTCCGTAGTTGTAATTCCATGAA |
| chr7 | GATATGCAGAGAACTTCGCAATGAG | ACTAGTTTTGTATGTGCAATCTGCT |
| chr7 | ACCATGGGAAACGAGGTTATGATAT | TCCATTGGCTTTCTGACACTGTATA |
| chr7 | CAATGGAAAAGCAACAGAGTTTTCG | CCTGGCGAATCTTTATTCTTCTTCC |
| chr8 | ACATTTGTTTTTATATTTTGTCGATGGT | TCACATTTGAAAGAGAGAATAGAGGA |
| chr8 | GAAGGGATGCACAAGAGAAAAGAAA | CTGGATGTTGTCAATGAACTTCTGT |
| chr8 | GAGCGTTCCAAATTACAGGCATAAT | ATTCCTAAAGACGTGAAACAAACCC |
| chr8 | TGTTAATATATAAGGGGTCATTAAACTGAT | TTTTCTTCTAGTTCCTTACCCCCTC |
| chr8 | GTAAGAAGACCATAGAGAGGCCTTG | GATGTTTTGACTGCAGTATCAACCA |
| chr8 | GTGATTTTTCCAAATGCATGCAAGA | AATGAATTAACTGGGGCTGTTACAG |
| chr8 | CCAAATTTCTTTTGCACAAGACTGG | GCAAAATTCATCAAACCAACAGTCC |
| chr8 | ATGATTGTACACAAACCGCTAACAG | GTAAATGTTTGGCTAGAACCTCTGG |
| chr8 | AGCTTCCTAAAAATCCATCCATCCT | AAACATTTGCGAGAAATTGTTTGCA |
| chr8 | ATATCACTCACTTTGCCTCTTTCCT | ATCACCCTTAAGATCACAAGACCAA |
| chr8 | TGCAAAGGATTACTTCAATCAGTCT | TACTAGACTTTGGGAATCAAGGCAT |
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| chr8 | CCAAGTCACAAAATCCTACATGTGT | GCAGTAACAGCATCCACATTCATTA |
| chr8 | CTGGAATCTGTTTGGATCTCAGGTA | ACTAGCACTGCAGTTATGTCCTTAA |
| chr8 | GATGGCTCTGCAGTATTTAACAGAA | ACCTGTTAAAAATGACCTAAAAGCAGA |
| chr8 | TGTAAATTCATCCAGGTCCCTGAAT | ATGCAAAAAGACATTAGCACAGACA |
| chr8 | TCTTCTTCAAGCTCTACACGATCAA | GATTCTCATCTACTGGGCTCACTAG |
| chr8 | TAAAGGCTCCCAGTTGAAGTCTAAA | CATTGATTTCTCCCCAAAGAGTCAC |
| chr8 | GCTTCTCATTTCATCTTTTGGGAGT | TGCTATCATATGGAAGTTACATCATCA |
| chr8 | TGTGCATTTACCAAGGAAACAAAGG | CAGCTGCATTCTCTTTGTTTCTAGG |
| chr8 | CATATACAACATCCATCGCAGTCAC | GTAAGGTCCTCCGAGATAACATTCA |
| chr8 | CAACACCGGATTGATATCTCCAAAG | GTGGACTATCGTGGAAAGAACAAAG |
| chr8 | GGTGTAATATGGTAGCTTTCGAACA | TGGGGTCCATAGGATAGCATAGTTA |
| chr8 | TCTACCACCTTTGATCCATTCATGT | ACCCCTAAGGAACATGAAACACTTA |
| chr8 | AGTGATAACAAACAATGCAGAAACT | GGATTTCAATGCGACAAAATTCAGG |
| chr8 | AACTGGATATTCTGGCGGATCATTA | AGATCGATAAAGTTGCTTTGATGCC |
| chr8 | GAAGACACTCCTTCCACTCTTACTT | GGCGAGTGTAATGTTGTTTTATGGA |
| chr8 | GAATTGAGAGGCTATGACCTTGAGA | ACATTTCTTCCAAAATCTTTTCCACA |
| chr8 | TGGTTCCTCGAATGCTTTTGAATTG | CATGCAGATTACAAGTTCTGGATCA |
| chr8 | CAGGAAAGACACCAGGATTAAACAT | TGGGATTTGTTTGAACACCGTTTTA |
| chr8 | TATAACACAATTTCAGCATCTCCGG | TTACCCTGAGTTTAGCCTACAGTTG |
| chr8 | ACAAGCTGGTTAAAAGAAATGGTCA | TATTTGCAATCTTGTCACAAAGCCT |
| chr8 | CGTTTGTGTTTTGTGAATTGAAGGG | CTTTTGGGGCTCTTCCTTTGTAAAA |
| chr8 | TGATGGTCAGTCGCAATAATAATTAT | ACTTGAGAGCATTTTTGAAGTGGG |
| chr9 | CAAATTGCCTCTCTACAGCCTTATG | GCTGAAGAGCTAAGACTCCATTAGA |
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| chr9 | CAACCATCGTTTTCATCTACTTCCC | CTCGACGGATAACACTGTAAGAGAA |
| chr9 | CTATGGCTGGCATCTTCCTTATTTG | TTGATTTTGTAGCCGAGAAAACTCA |
| chr9 | TGCTTCCAGATGAAAATCAATCAGG | AAGAATGTTGCTTTCAGGTGGAAAT |
| chr9 | TGCCCTTCATGGTATAAGCTATCTT | TCTCGAACAAAGTATGACCAGACTT |
| chr9 | AACATCACTAGCTTTGTGTTCATGG | GGCACAAAATTGCAATCTTGTACCT |
| chr9 | AGAGGGCAAGAGAGACTTTATTTCA | CCTGAGGCTAAGGACTTTGTAAAGA |
| chr9 | TACATTGAACCAGAATGCTGTGAAC | TTTATAGAGTCTGGGGAATTGGACC |
| chr9 | TCATGCTTCTGCTTTGCATTAATGA | ATCATCTTTGCAGAATCGTAATGCC |
| chr9 | ACCTTGTTCCCAATTTCAGTTTCTG | GGGCCATCCAGGTAATTAAATGTTT |
| chr9 | TCCTTGATTTTGGGCCAATCAATAG | AAGACTTGTTTCAAGATAAGCCTCA |
| chr9 | TTGCTTCAACTTAAATGGAAGCAGT | TAAAGAGGGCACTTGTATATGCCAT |
| chr9 | TTAACATGAAGGGTCAGTTAGGAGG | TTCTTGTAGGTGCACTTGTTTTCTC |
| chr9 | GGGAGAGGAAAAAGCAAAACTCTTT | TTTTTACTAAACTCACGGGATTGCC |
| chr9 | TGCCAGGATATCAGAAACACATACA | AAGATGCCATGGAAGATTCTATCGA |
| chr9 | GCTGACTGGAACATTTTGAACCATA | GCATCTTTACCATCACCTTCCAAAT |
| chr9 | AGGCATCGAACTGGTAACTAGTATC | GTCTTCTCACATTTCAGGGGAAAAG |
| chr9 | GCCTCATTGAGACAAACTAATCCAC | TGCTTGGAGATATTGATAGGCTTGA |
| chr9 | TGAGCCGGAATACATGTAGAGAAAA | CCGTTTTCTAGATTTTGTTCTGCCT |
| chr9 | CATCCTTCATCTCAGTGAGTGTACA | CAGACTCCAATGCATAACCAAACAA |
| chr9 | TTCTGGCCATCATCTGATTCAATTG | GATTTCAGGTTTGGGATGTCTTGAG |
| chr9 | CTTTCAGATGAGCTTTGTACCAGTG | AAGGTTTTCTCTATCACTCAGCAGA |
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| chr9 | TCTCAACTTCAGTGAATGGGAAGAT | GCTTGTAGAAATTGGTTCCTGAGAC |
| chr9 | CCCTGTCTTTGCCTTACATCAAATT | TGCATACATACTAGCTGAGGGAGTA |
| chr9 | TCAAGCCTCAAAATTCCACTTTTGT | CAAATCATCTCCACCTAAACGATGG |
| chr9 | GTTTCTTTTTGTGTCCTTAGGGTCC | AAGACCAAGCTTGTCAGTTATCTCT |
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| chr9 | CCTCATCAGAAAACATGCATGTCTT | AGATTGTTCCGTGTATATGCTCACA |
| chr9 | TGATGCCAGAGAGAGAAAAAGAGAA | CGTTAAGCTTCCATCGTTATTTCGA |
| chr9 | GTGACCTAATGACTTGAAAGCTTGA | AGCACTGCAAGGTTCAAGAAAATAT |
| chr9 | CTGTATTGTGACAGCAAATCAGGTT | ATCAACCACTTTAATTGCAGCAAGA |
| chr9 | TCTGTTTACAAGAGTCAGAAGGTGT | TGTCATTACTGAAGCAGCATGTTTT |
| chr9 | GCATACCTAAACCAAAAATGGTGCT | TCTGGTTTTATCAATAAGCAAGTGCA |
| chr9 | TTCAAATTTCACATGAAAATCACCTT | GTCTTAGTCTTGTTTTCCTTCCTCA |
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| chr9 | TTGAGGTCTTATGCACCTTAGACAA | CAACCATGCACATATTCTTGAACCT |
| chr9 | CGAGAAATTCAAATACCTTTGTGCC | CCTCAAGTTTGTGAACACCTTTTCT |
| chr9 | GGTCCAGTGTAAACGTAAGGTCTAT | AAGAGCATAACCTTGAAGAGCAGTA |
| chr10 | TTTGCAAACACTGTAACCCAATACA | CAAATCGAACTACTTCATCGGGTTT |
| chr10 | TGGGGATGGTTTTGTTATGAGTTTT | ACATCATAATTGAGCATAAGGAAGCA |
| chr10 | AGAAGTTTGTGATGCAATTGTAGCA | CAATCCCCACATCAAACCTGATTAC |
| chr10 | TGTGGTCTCCCATTATAGGTACAAC | AAAATGAGTCCAAATGCTGTAACCC |
| chr10 | GCGCTTAATCTCAGTCACATAGATG | GCAACATCTCATAGGCCTCACTATA |
| chr10 | GGTGCTATGCTATTTACTTGTGCAA | CTCTATATGAACTTCCTTGGTGGCT |
| chr10 | TTCTTTTGAATGCGACAGAAACGTT | TAGCTTTCCCTGCAATTTGAAATGT |
| chr10 | AAATTTGGGACTGTCGCATAAAGTT | TTCCACACCTCAACAACCAATAAAG |
| chr10 | CATTTTGTGACTGATCAGCACTTCT | GAGCTTTGTTAAAATTGGTCTGTGC |
| chr10 | ATGGATACTGGCTGTAGGTTAATCC | TGGTTAGTTGGAATAAAATACGGGG |
| chr10 | ATTCAACAGTTGATGGATTCCGTTT | AGATCAATGATTTTGCTGCAATGGA |
| chr10 | CAGCAGTAAGTATCACCCAAAAAGT | GTGCTTTGTAGGAAGATGAGCTTTT |
| chr10 | TTGTGGTGAAAGTGTTGGGATAATG | TGGAACAGGAAAAGTTCTCAGTTTC |
| chr10 | ATCTCTGATTCTCTGCTATGCTCAC | TGGGGTTTTTCCACTAAAGATTCTC |
| chr10 | AAGCTTTGAAGTGTTGCTTGAGTTA | AGGCAATGAAGATAAGGCTTTGATG |
| chr10 | TCTGTTTGTGTAAGCCTTTTCAAGT | TTTATCGAGGAGCCTGATGAAAGAA |
| chr10 | CAAATGTCCATGCAAGAAGATACGA | GTTGACCTTGTAGAGATGCAATCAA |
| chr10 | ACTTGTTTGGAAGACTTTTTGTGTT | TGTTTCCACTCTGTTGTTGACAATC |
| chr10 | AACTTGATCTCCTCCATTTTCTCCA | TTGACTGGGATGTGATTTTAGTGGA |
| chr10 | CGCCATAAGTGTCCTTCCTAAATGA | TGGGGAACTTTTTGGTGTGATTATG |
| chr10 | CCAAGAAGTGCTTTGAAGAGTTGAA | TTATGAATTTCCACCATCCAGCATG |
| chr10 | ACTTGTGATGTCCATAATCTTGGTG | CCTATGGAAGACTGAGGGATTCTG |
| chr10 | CACCACTCACTCCAAATTTTGAAGA | CAGCTCTGCAATGAATATCAACCAT |
| chr11 | GACAATAGCCTTTGAAGTGTAGCTC | ATGGTCTGGAACTTGATTAGTCGAA |
| chr11 | CTATTCCTGCCTCTATTGCAAAAGG | ACTTACTTGCATGCATTGAGAAGAC |
| chr11 | ACACAGAAGCTAACTTTGCATCAAA | ATGCAGCAACACAAGCAATTTTAAG |
| chr11 | ACTCAGATTCATGCACAATGTCATC | GGTTAGACAATTACTCACTGTCCCT |
| chr11 | GTTCTGTTCGGCAAACATTAGTAGT | TTCATATGAGAATGCTGTCTGTTGC |
| chr11 | ACCACAAAAAGCTCCAAAGAAAAGA | TGATGTTGTCTACTCTCATCTGTGT |
| chr11 | TATGCAGCCTCTGTTACTTCTGTTA | GTGAGCACAACTATCACTTTTTCCT |
| chr11 | ACCACTACTACTTCCAAATGCAGAT | GAGATGAACAATGTCCAAGATGGC |
| chr11 | GCTTTCTTTTCCTTTAACAGGCTGA | TGAGCCACATGTTTAACATCAGTTG |
| chr11 | CAAGTTTTACGTGGAAGATGGTTCA | TTGCACGTGCTTAGAATATTGAGAG |
| chr11 | GCTCTTCAACTTATGCCTTCTTTGG | AATTTCCAGCCTTTAAGACTAGCAC |
| chr11 | TGCAAAACTTTCCTTATGAAGCCAA | ATTGACTCTGTTGTATGCACATGTG |
| chr11 | CCCCTGTAAGGAAGACAAGATTTTC | CCTTTCATGCTGAACAAAATGGAGT |
| chr11 | TTCTGTAGTTCAAGTCATGGGGTAG | ATGTAATCAATTCCCAGAACGCATG |
| chr11 | TTCAAGACCATCCTTGTCTCTTCAG | GCTCTCTCTTCAGGATTGCTGT |
| chr11 | GCAAGAAGCAGAGAAGAACAAATTG | TAATAATAAGCTCGGACTGGAACCA |
| chr11 | ATCAACATTTCTGTGTGAGATGCAG | GTTGTGGGTTAAGGTTTGATGGAAA |
| chr11 | AGAATTGGGCAAATGAATACTGGTG | GTTGCTTATGGCTCCAAGAATGAAA |
| chr11 | AAGTTACTGTTTGGGAATGTAGCAC | TACAAGTGATGGAGGAAAACAGCTA |
| chr11 | TATACCCTTGAGACCACTATGTTAGG | TAAAGTTTGAACTGGTTTGTCAGGG |
| chr11 | AGACAAAATGGAAAAGTTGTTAAAATTTATAA | TCCTCTTGAACCTACCACATACATC |
| chr11 | AGAAATGAACAAGACAATCATCAGCA | TACACTAGCAGAGATTGAGCACTTT |
| chr11 | CAGGATTTGTGACATGCATATCCAA | CTGACCATGCTTCAAATTAGCCTAG |
| chr11 | TATCCATGCACCAGATTAGGGAAAT | TGACATTTCTAGACATTCCCAGCTG |
| chr11 | CCTGTTTGGAGTTGATTTCTGTAGT | GCACTATATTTGCTGGACCTCAAAA |
| chr11 | TGCATTGTTTGGTTGGATGTATGAA | GGAGTTCTTACTTTCCACCCACATA |
| chr11 | AAGTTTCACACAAAAGGGTAAGCAA | TGACAAGTTGAGTACTCTCTTCAACA |
| chr11 | CTCTTCACAGGATAGATCTCATGCA | TCATATCCCTAAATTGAGCATCAAGC |
| chr11 | GTTGCCGTGGACTTTAAAGATCAAG | TCTGACAAGGAAACCATCATCCATA |
| chr12 | GGAATAAGCTTGAGGAGAAAAAGGA | TTACCTTAGTTTTAGGGGCAAGACC |
| chr12 | GGTTCTTCATCAATGATGACTGGTG | AGTTTAGCTGTCTGGTGAGATTCAT |
| chr12 | ATCATGAACCTAAGCGACGACATAT | TGGACATCTGAGATATAAATATGTTGACG |
| chr12 | TGTAGGTGCATTTAGAGAAGGGAAA | AAGTTCAAGTCCTGCATCATTCATC |
| chr12 | TGGCTAAGAAAGAGAGAGATATGGC | TGTCATTGCATTGTTTCATGAAAGA |
| chr12 | AGCAATGGACAAAAGGGACTACATA | AAATCCAACGAACTCACAGGTTTTT |
| chr12 | ACTTGAAGATTGTATAAGTCGTGCC | GTGCTAACTTGTTAGGCATCAAGC |
| chr12 | GCCATGAACAGGGTAAGACTTCATT | GCACATGAAAAGAAGACCAAAAAGC |
| chr12 | GGATTGATGTCTCATATTTCTTGATCGT | CCATAATGCTTTGCTTTGAGCTCTT |
| chr12 | TATCATTTGGCTCCTCTTAACGGAA | ACCATGAATATTAACCCGATGTGGA |
| chr12 | GATATGCCTTTCAGCCTTTGTTTCT | CCCCTTTGCTGTTTTTACAGGTTAA |
| chr12 | TTATGGTGGTGCTAATAGTCCACAT | TTGTTGCATCTCTCTTTCTTAGGGA |
| chr12 | ACTGGCAGGTTTTTCTTTGTTTCTT | ACTGCCAAAACAATACAATAGCACT |
| chr12 | ACAGGTATGTCCTTAACTTGAGAAT | TCTTATCCAGATCTGAGACAAGACG |
| chr12 | GTCTTCAGTTTGGGCATTTTTGAAG | CTATTTGTGGAGCAACGACCAAAA |
| chr12 | CAAAAACCAAACCAATCGAACGTAC | ATGTCCAAGATTATATGACTGGCGA |
| chr12 | AGCACTCATGAACTCTTGTAGAAGT | TCTATATTGGGCTCAGACAAAGGAG |
| chr12 | GCAAGAACTTTGAAGGAAGTGAAGA | ATATGCCAATATCAAGCCTACCTGT |
| chr12 | CCCCCTCCCTTTCCTTTTATTTTTG | CACACAAAGCCAGCTCTAACTATTT |
| chr12 | CATGTAAGCCACAGAGAAAACCTTT | TATTTTGAACCATACATGTAGCCGC |
| chr12 | AACTCAATTACCCCATCAACCAGTA | AGAGCGGACATTTCAACAATAAAGG |
| chr12 | TGGAAGAGAAGTAGAGGAAGGAGAT | AAGATCAACCTAGCGAGTCAATGTA |
| chr12 | TCAGTAGTTTTGTGGTCTTCCATCT | AGACATTGCATGGTTGTTTATTCTCA |
| chr12 | TCAATTCCATTATTTCCTAATCCTATCAT | TTGGAGGTCCCTTGATGCATATAAT |
| chr12 | GAGAATGAATATCAGTTTGCTCGCA | GAGCTTTGAATTGTGGTACAGGAAA |
| chr12 | GTTGAGCTGTGTGATGATGATGATT | AACTACAGAACTAAGGGGAAAGCTT |
| chr12 | GCTAGCTTCATGCATTATAGTATCCA | GCATTGGCTATATCTTTCTCAAGAACA |
| chr12 | CTAAAATCCCCAACATGCCCTTAGT | TCAAATTCAAATGTTTCCACCAAGT |
| chr13 | ATAATGGGGAGCCGAATCTTTATCA | CTGCTGCTGTAATGACTTTCTTCTT |
| chr13 | TAGATGGGTCAGAAACATTGGGAAT | AATTTGAAACGTTTTTGTGGCTCAG |
| chr13 | TTTGATTCATTAGCATCACCGATGG | CCACAAACAACAGAAGAAAGGACAT |
| chr13 | AATTTGTGATGTGAGATGGATGAGC | CAAATCAATCCAAGTTCAACCAGCT |
| chr13 | TGTCCTCTGTAATATGGCAGAAAGT | TTGCATTGCAAGATCATTAGGATTT |
| chr13 | GTATGAGCATCCACAGCACTAAATG | AAGAGACAACATTTTGTTTGGGTCT |
| chr13 | GCAATGTCCTTCCAATAGTTAAGCA | AGTTGGTATTATCTGATGGGATAGTGA |
| chr13 | ATGATCGTAAAGCAACTGAATCGAC | TCAAGTTGTTCGAGACAGACTGTAA |
| chr13 | GATGAAGAATGACTCAAGTTGCCTC | AAAGCTCTCTTTAAAGTTTGCTGGA |
| chr13 | AACGTGAGATTTTGGGTTGTACTTC | ATCCAAGATGAAAGTCCAATGCAAG |
| chr13 | ACTGTTGGTGAAAAGTGAGAGGTAA | GTGACCTGGTACAATGCTTTACTTC |
| chr13 | GGCAACACCAATTAGCTTATCAAGT | GAAGAATAGGTTCGCTGAAACGATT |
| chr13 | GTAGCTTTCTCATCCGTTCACTGAT | CAGAGATAGCTGCCATGGAAAAATT |
| chr13 | CCTCTTGCCTCTAACTCCATAATCA | ATTTCTGGTTCTTATGTACCTGCCT |
| chr13 | AAGTCCATTTTCAATGAGAGTCTGC | ATGTACTCCACTCTTGAGGAAGAAC |
| chr13 | TCCAATTCGGTTTTCAAAACATTGC | TTGTGCCAAAGAGCAAACTATTTCT |
| chr13 | TTCACATGGCTTGAGATTGAATGAG | ACATGTTTACTTGTGCATGGTTTGA |
| chr13 | TTTTGTTTTATTTTTGGCCAACGCG | CAGCATGTCAAGGTTGAGAGATATG |
| chr13 | TTCTTAGAAGTAAGTGGTGCAGTGA | AGCACAGGAAACAAAAAGTAAACCA |
| chr13 | CCTATTTTGTGGCTTCACCTTTCAT | CCCAAACTCCACTCAAGACATAGTA |
| chr13 | TTACATACACATGCATGATGAGCAT | TATTGCTGCTTCTTTCTTTGCTTGA |
| chr13 | TTATCCTGATGATGCCTCTGAATAA | AGAAGGCATATTTGAACTCACGTTG |
| chr13 | ACTGTGAGAGTGATACCCAAAATCA | AGAAAATGCAGTTGAAAGACTCTGG |
| chr13 | ATGACTAGGACTGGACAATTCACAA | TCTGGTCTTCGTGTTATGTATCCAG |
| chr13 | GCATGCAGTTAAAGCACACATATTG | GCCAGTTAGAGTCATCCTTGAAGTA |
| chr13 | ATGCTGGTTAGGAACACATATCCTT | CAACCCAATACCAAAGCCAAGAT |
| chr13 | ACAGTGACTTTGTTTTGTTTGTTATGG | GCTCCTCAATTTTGCAGGAATAACT |
| chr13 | TGTTTTCTGGTATGCTGGTGTTTTT | GAAAAAGATTGACCCAAACTCCTGC |
| chr13 | AAAGACCAAAACAACACAAGTGTCT | GTATGCTCGTTGGAGAAAACTTGAA |
| chr13 | TCCACTGGCAAAGGGTTATTTAGTA | ACCGAATTCGAACCAAACACTTTT |
| chr14 | GGCCTACCTCATCTTCTAACTTGTA | AATGGATTGTTGAAGCTTCCGATTT |
| chr14 | CCTCAAATCATCTGATGCTTGAGTC | ACTAGGACATTGCCTGAATCAGATT |
| chr14 | TCAAAGTATACGGAAAATGTATAATTGATCA | GCCCTAATTTTATACATCCAAGGACA |
| chr14 | GCATATCCTTCAATTAGGTTGTCCA | TAATGAAGCGCAACTACCCAAATTT |
| chr14 | ATCCAATAGCAAACCTGTCCACTAT | TGGCGAAGAGATAATTAGTGTCACA |
| chr14 | AGCATTCCATGAATTCCCTTTTTCA | AATAGTGAGCTTGAAGTCGATGTCT |
| chr14 | GGTACAAGCTTCTTGACATTCCAAA | TTCTTATCATGGCTTTGTGTTGGAC |
| chr14 | AGGTTCTCTTTTGTAGCACAGAGAT | CTGATGGGCGAAATGTAAAGTTGAT |
| chr14 | GAAATGCCATTTGATCTTTCACTGC | TCCATGAATTTGCAGGTGAATACAC |
| chr14 | ACTTCAAAACTTATGTGCGAATGGT | GTTCCCATATCAAAATCACGGAACA |
| chr14 | GTCCTCAAACTTCTGAACCTCAATG | ATAGATTTGCAGAGGAATTTTGAGAA |
| chr14 | GCCATTGAAATCAACCCAAAAACTG | TATGAGCAAAAGGAGAACATGGGTA |
| chr14 | AGATGAAATTTTACCTGATTTGTGCT | ACTGCAGAGGAATTATCGATTTTTCT |
| chr14 | GTTTGAGGAAGTGATTGACTGTCAG | TCTCATCAGTGGATAGAAAAGCCAA |
| chr14 | GCAAGGAGAGGCATTACATACCATA | ACAAGAAAGTGCATCCATGTAGTTG |
| chr14 | AGAGTCCATCTTTCTCAAGTCAACA | CTGCAAGCAAGGATGATATTTCCAT |
| chr14 | TGAGATTCTTTTGTTCACCGAGATT | CATCTTGATCAATCCAATGGCTGTA |
| chr14 | CAAGCTTCGTTTTCAACTCATTCAC | GGAACTGTAATGCTGGTTTTTGGTA |
| chr14 | CTGTCATTTTGTATCTCTCAGGCAT | GGCTTGGTTTCTATTAAATTGCAACA |
| chr14 | TTTAATCTCAACGATGCTGTGACTG | AAAGGTTACCAGAATGCCTATCAGT |
| chr14 | TCTGCAACATTTGTCTGCTGTTAAT | TCAATGCCCTTCAGACATACTTGTA |
| chr14 | TAAATAAACCCTACTGTCACAGCCT | GGAAGAGCGATTGAGAAAGGATTTT |
| chr14 | ATCCCATTTTGATTCTGGCACATTT | TCAAGTAATCTCTGATCACCTTCCC |
| chr14 | GCTGTGCTTGATGGTATCAGGTAT | AGGGTAAACTCTGGTGTACAAATGA |
| chr14 | ATTTACTTCATACGTACGTGTCTGT | AAACAAGGGCACAATTTATCGACTT |
| chr14 | TTGTTGTGTTCTGATTCCGTACTTG | AAGGCATACCAGCTTTGATTTTCAA |
| chr15 | AACTTCAAAAGAAGCTTTGCCTGTA | TCCTGTCAAGATTCATGGAGTCTTT |
| chr15 | CTTCTTCCACCACATCTTCTTCAAC | CTTCGACAACAAGTACTACGTTGAC |
| chr15 | AGACCTTCAGGCAAGAGGATAAATT | AAATGATGGTCAGTCAAGGTTTTCC |
| chr15 | TCCATCATTGTACTCACCATAACCT | GTCTTGGAGGAACTAGCTCCTTTAA |
| chr15 | TATTTTATCCCAGTTTTGCTCCAGC | GATTGGATGTGTTTTGTTTTACGCA |
| chr15 | CTCTAACGGAGGAGATCAAAAGCC | AAAGATTGCAAGAACTTACACTCGG |
| chr15 | TGTTTTTGGGTCTTATACTGGTTGC | GAGCTGTGCGAAGGATATTAACAAA |
| chr15 | GGTTTGCCATAGAGTTTGTGTACTT | GTTAAATAGTTTACCTGCAGCCCAA |
| chr15 | TTTAGTGTCATCGCTACTTGGAAGA | AGATCCTGAAAACCAAATCAAGCAG |
| chr15 | CTCGTAGGAATCTTCATGTAATGGC | TGTGGTACTTTTTAACTGAACTTCA |
| chr15 | ACTGGAATACTAGACTGAAGAAAAAGC | CATGGTCATCATCTCCAGAGAATCT |
| chr15 | CTGCTGAGACAGAGAACAAGAAAAC | AGTGCTTGTTGTTGTTGAGATGTTT |
| chr15 | CACTCATTTTATTCATCAGTCCCCC | GTCACCGTCTGTCATTTCATTTGAA |
| chr15 | GTCGTTTTATGCATGACAAATTTGC | CATGAACCAGAGGCTTCATTAACAA |
| chr15 | TGTTGTTCTTGTGATTCTGGTAATGG | AGCCACGATTTTGAAAATCCATACC |
| chr15 | GAAACTGAACCCATCTTGTTCTCTG | TCATTTTGACTGTTGCATAAGCGAT |
| chr15 | GAAAAATGGGCAAAAGGGTTTGAAT | CTGACTGAAATTTCCGCAGAATCTT |
| chr15 | AGGCCTATTCGACTAAATCAAGACA | TGATGCTGTTGTTCTGGCTTAATTT |
| chr15 | AATTTTTGGAAGCCAGACCTTTGAG | AAGCCAATTAGAAGCAACAGTTGAA |
| chr16 | CCAATGTGGTTCCAATTCCCAATTA | TGTCACCAATACCAAGTTTAGAAGA |
| chr16 | TCATCAAGTTCGCAGTTTTAACACA | GAGCAGTGAAGATCAGCTACAGAA |
| chr16 | GGAGTGATACATCTTCCACAACTCT | TCCGAAAATCTCACAGCTTTTTCTG |
| chr16 | GCATCAAATTATTTTCCAATTGCAGC | CTCCACTGTCTTATCAAACCTGAGA |
| chr16 | CTCAGATTGTGGGATATTAGGAGGG | GCAGGATGACCCCTAAATGAAGATA |
| chr16 | GCACTTCTCTTCACTCTTTCATTGA | GAGAATGTTATTTGTGTTGAGGGGG |
| chr16 | GATAAGAACCTAATAGCCACCTAAAG | GCAAGCTTTTGATAATACCCTCTTCA |
| chr16 | AAGAAAAAGAATACTCACAGGCTGC | ATCAACTCAGACTGGACTTACTCTG |
| chr16 | CTCAGGTGGATTGGTGTGAATTTTT | AAACAACAACAGAAACTTGTCCTGA |
| chr16 | GGTAGCATTCCACAAAGTATGTCAA | ATTACCATGATCAACAACTCCTCCA |
| chr16 | GCTGGAGAAAACTTGAAGGAAAGAA | GCACACTCAAATGACTTTAAGCAGA |
| chr16 | AGCCCTGATGCATTTCTTATTCTTG | GCTCTCCCTTGTAGTTCTTTAAAGC |
| chr16 | CAACTTCTAAACCCTACAAAGCCAT | ACCCTAAGCCCTTTGAGGATAATTT |
| chr16 | ACAAGGTTCAAGTAATACTTCACGC | TGCTCTGGTAAACACTGAATTTAGC |
| chr16 | GGGATGTAAATGTTGCATGTGCTAT | AAATTACACCCATGATCATACCTAATG |
| chr16 | TCTTCCTCAAGTAGTTGGATCTTCC | TGCATCACAAGTATAAGGAGTGTGA |
| chr16 | TGTTTTTGCATTGTTTCATGAAAGA | TGTGATTGTGAATGTCTCTCCTCTT |
| chr16 | GGTGTTCCAACCAAATGATTAGGTT | TGCCACTATTGTTCCTTCTCTTTTG |
| chr16 | AGTGTGTGTAATTGGGTTTCTTGAG | GGTGGCTGATATAGTGGGAAAAATG |
| chr16 | CTGCTACCTTTTCTCCTGGTCTTAG | AGTGAAAAATACCACAACTCTGCAG |
| chr16 | AAGAAAGCTTAAAGGTTAGGCCTCA | CCGAATGAGACTGATTTTGTGTGAA |
| chr16 | GTTCTTGCATTGTTCACATTTGACA | AGTATGCTTCCGGAGAGATATTGTC |
| chr16 | GAGGTCTGTCGAGAGAGAATCATC | AAAAACCTGTTTTGCATTGGTAACA |
| chr16 | TCTTGAGTCTCAGATGGGAAAAGAG | GAAATGGCATACAGGAGAAGACATG |
| chr16 | TGTAAATTGGCTGCATTCATGAAAA | TGATACACAAGCACAATCATTTCCT |
| chr16 | ACTAACAAGCCCTAGTCCAAAAGAA | GATGACAGAATTGCAAGTAGACGAG |
| chr16 | ATGGTTAAAAGGAGAAAAGTGCAGG | GATGTGGAGCCTTCTAGTCAGATTA |
| chr17 | TCTTTGTCCATCATACTTTCACCCT | AACTGTTGCTAACAAGGGTTTGAAA |
| chr17 | AAGGATAGACCGTTGTGTTGACATA | GGGATGGATTTATGGTTCAATCACA |
| chr17 | GGCTGACACATTCAATGAAGGTAAA | ACCTCTTCTGCAATTGTTTGTTCTT |
| chr17 | ACACTTAAAAGAAACCATAGCCACA | ATATATCAATATGCTTTATAGAAAAAGAATACCA |
| chr17 | GACTTGTGATGAGATCCTATTTGCG | TCTTCAAAGGATCATGTAACTTGCA |
| chr17 | GTCTTAACACTTTCATGATGGTGCT | AGCAGTCTTCCTGTTGATTCACTAA |
| chr17 | CCCACAAAAGACTACAAAAAGAAAACG | GGCTTTTCTTTGCAATTCTTGGATC |
| chr17 | CTTTCAGCATTTGCACCAATGAATG | AATCAACCCCAGAATCACAATTGAC |
| chr17 | CCAACTAGTGGCCTTTATTTTCCAC | AAGCATTCAACATATCAATCGGCAT |
| chr17 | TGCAAAGCAGTTATTTCAGTTGTCT | TCTTCCTCTTTCACGACCTATAAAA |
| chr17 | TTATGGGAAGATGTCCTAAAACGCT | GACACTGAAGAACAATTCGGAGTTT |
| chr17 | AGTTCTTCTTCAGATCCATCAGTGA | AAAAAGCCAACATCAACCATCTCTT |
| chr17 | GGTCCATCTCTTCGTTTCTCAATTC | GGACACAACATGAATTCAACGAGAA |
| chr17 | AGTATGCATGCAATAGGGTTAGGAT | GAAATTGTATCTACTGCTCCTTGGC |
| chr17 | GCAAGAGGTTTTACTCACAATTCCA | CACTTTAGATCATCGCCAACTTGAA |
| chr17 | TGTTTATGCAGAAAACATGGAGATC | CTTGCTACCTTCTCAAACGTTTCAT |
| chr17 | GCCTACTGATGGAGATAAAAATGCC | TTGGCTTCCCATCAAACTCAAAAAT |
| chr17 | ACCAGTATCTTAATCAGGGGTTTGA | ATATTTCCTTCTCAATGAACCGGTC |
| chr17 | CCATCATCTTTGTGGGTTTGTTGTA | CAGCTTGCCTATGACTTTTTGAGAA |
| chr17 | AGGATGGAGAAGAGATGGACGATAA | TCAAGTGCTTTAGCTTGTTTAGTCT |
| chr17 | TGCAGCTATAAGAACAAGTAGTGGT | TCCGTTCGTCAAATTTTGATCTGTT |
| chr17 | CCCTGTTGACTGTAAAACATTCACA | CTGGGATTAAAGGCCCTGAAATTTT |
| chr17 | AAATGTTGGCCTTGTACATAACCTC | ATGATATAAGAGGTTGCAGATGCCT |
| chr17 | CCTTTAATCACAGCCAATTCCCAAT | ACTCTGAATCTACAATGCAGTGGAA |
| chr17 | ACATACGTAGATCATTCTGAGTGCA | TCTCTAGCAAACTTGTTACCGAGAA |
| chr18 | ACAATAGGGACGACAACAACATAGA | CACCCAGATAAGAAATTGCTCCATC |
| chr18 | CTCTCAGCCATTTCAACACCAATAA | AGTCCGCACAATAACTTAGAAAACG |
| chr18 | ATTTCACAGCCAAGACAGAAATGAG | TCCATGCTAATATGTCAACCAAAGC |
| chr18 | AATAGAAGCTGAAATCTGACCTGGT | GAAATTGGCACACCTTCAAAAATGG |
| chr18 | CATGCTTATCAGAGGAAATCCCAAC | GAAGAGATCCTCATAGCATTGCTGA |
| chr18 | CAACTTCTCCTTTCTCCCAAAATCC | TGACCTTTCAATATGTCTCACTCCA |
| chr18 | TTCAGTAAGGATACCATTGCTCCAT | TGCAATATTCAGTAACTTGTAAGAGTGA |
| chr18 | TATGACTAGTAAGGGAAGGAGGAGG | CATTGAGCAGAGTGTCTCATTAGAG |
| chr18 | CTCCTGTTGTTGTTGATTCAGACAT | TGCATGCTTGTCCATTATTACAACC |
| chr18 | GCCACAATTGCAACATTAAACTCTG | AATGAGTTGGTCTCTCTCTTGTCAG |
| chr18 | GGTCTTAACCATGGAACTACCAGAA | CCAATGGGAGGTTTAGAAGGACTAT |
| chr18 | CCCATCATTGTTGCCCTAATCTCTA | CCAGGGTTCAACAAAAGCTAATTGT |
| chr18 | TTCAAATTTGGCACCTTCTTGTTCT | GCTAGAGCCACTATGAACAGATACA |
| chr18 | ATTTTGTCATTGCTCATGATGGGTT | AATGAAGAAGGCATGCCAAAACATA |
| chr18 | ATGCTCAAGCCATTGTCATAACATT | ACAAAGTAACTTGTCCACAGTTGAC |
| chr18 | TCTGTTTAGCTATTGCACTGATGTG | AGCAGTCACTGAAACAAATTCCATT |
| chr18 | GGTGAGCTTGCAAATGGGTATTATT | TTCCTGTAACGTATCCCTCAAGAAG |
| chr18 | GGAAGATGGCCGTAATGAATCATTT | ACCACTTTCCACAGCATAAAATTGT |
| chr18 | CAAATGTCCATAACCATCACCCAAA | TGAGCAACTATCAAAGAAAAGCAGG |
| chr18 | TACAGGGAACAGCTTGATTCACTTA | ATTTGCTCTGTATCAATGGTAGGCA |
| chr18 | ATCATCCCAGGTTTCTCCTTTATCC | ACTTACTAGGTTCAGGTAGTTGCTG |
| chr18 | CCCCATTTGGCATGTTGAATCTTTA | TCTCATCCGAATTAGTCCACTCTTT |
| chr18 | TGTATGGATTACACAAGGCCAAGTA | CATGAAAACCGACTTAAAGGGGAAC |
| chr18 | AACCTTCATCAGTCCGTAATCAGAT | TACTGTATCTTGTGTGCCAATGGAT |
| chr18 | CCACCAAATTTTGCGATTGGTATGT | ATCATAACATACCACAGTAGCTGCT |
| chr18 | TGATGTCAAACAACTCTCAAACAGG | AACTTATGGAATCCGTACTCAAGCT |
| chr18 | TAGTCTGGTCTTGAAACCTGATGTT | TTCATCAATAAGAGCAATGCCCTTC |
| chr18 | CAAATTGACAGTTGAGTCTGTTCCA | GAAAGCTTCATTGTTCTTTTGGTCA |
| chr18 | TGCAATCCCTGAAATCACCATTAAG | GCCAAACAAATGAAAATGAGTTGGG |
| chr18 | AGATAGCAAAACAACAGAATTCTAGCA | GTCTTAATACTGCCATCTTCAGCAC |
| chr19 | AGCTCTTGCGTAGAAATTGCATAAA | CCCCATTGCTCCTTGATTATGTTAC |
| chr19 | TTTTCTTTTTCCAGGGTTTGAGAGC | CTTCACTTCCCATTTGTATCTGCAG |
| chr19 | GCCTACAAAAGTGCAAACTGTATCT | GCTTTAGCAACTCTAATGTATGCCC |
| chr19 | GAAACTCTTGCACAAAGTCCACATA | TGGATAGCGAATCGATTAAATTGCT |
| chr19 | AGAAGAATGAGACTTCAGCCACTTA | TCAAAAAGAAGGCCCTGAAAACTTT |
| chr19 | GTTAGATGATCTTGATGCCCCATTG | ATACCCAGTCTCTTGTTTGATGGAA |
| chr19 | AGCTGACTCCTACTTTAAGCCTATG | TGTCCATTTGTTTCCAGGTTTCAAA |
| chr19 | GGAGATCCCAACCAAAAGATAGACT | TAACTCATCTGACCATAATCGTGCA |
| chr19 | TCTAACAGTGCCACTAAAGTAACAA | ACTTGAGTTTTTCTTCAAATCTTCAAGA |
| chr19 | TCACGTACACTAATCAAATCCAAGA | TGTGCATTCTTTGATGTTCTTCACA |
| chr19 | TGAGATTTGGACTGAGGGATAATCC | ACTAATTTGCTTGCTTACCAATGCT |
| chr19 | TTGATGAGAATTCCCAGCTTAGACA | AGCATGATATGTGGGTCCATCTTTA |
| chr19 | AAGTGAGAGAGAAAGAAACTCGGAA | GCGGTTACTTACTTCGCCTTAATTT |
| chr19 | GGTTTCAACTTTTGAGGCCTTTAGA | CTCCCGCAATTCCTTCAAGTAATTG |
| chr19 | AATGATACAACAGCATGGCATATCG | TAAACCTAACAACATCTTGCTGCTG |
| chr19 | AAAACCACTCACTCTATCTGGAACA | GTTGGCATTCATGAGTGTCCATTAT |
| chr19 | CAGTACTCAAAAACACCTGTACCAA | GGTCCCCTGATCATATTCATGGATT |
| chr19 | TTCCCAAATACTCCTACTGCAAGTT | TCAACTTGTCTATTAGGCTAGGCTC |
| chr19 | CGCATTTCCTCAACAAGATCATACA | GGGAACATATCTCCTCTGGCTTTTA |
| chr19 | CGCAAATAGGATTCTATCATGGCAA | AAGGCATGAGTGAACTTTCATTAGC |
| chr19 | GCAGCCTAGAGACAAATTCTGAATC | TCTCTCATCAACATTACTGCCAGAA |
| chr20 | AGTGAAAACTTTGGTCTAAGGCAAC | TCTGAGTATCAACCTAAGGAGACCT |
| chr20 | TGCTACCTAAAACTTCCAGGTTGAT | GCTCATAATTGTCTCTTTGATCAGCA |
| chr20 | GATGATCAATTGCAACTACTCAGCA | CTGTATTCCATGTATACCATCCCGT |
| chr20 | ATAGAGTCTTGTTCCAACGAAAACG | CTGCCTCTTCAGCAGTATCATAAGT |
| chr20 | AACTAGCTGAGAAGCGTCATTTTTC | GTAACAAGTCCCAAATCAGCAGAAA |
| chr20 | TGAATCACTCATACAGAAAAACTAGGA | GGATACCTCCTCTGATTATGGAACC |
| chr20 | CATCTCAACATATTCATGGCCCATC | TTAAGGAATGACCCCTATCGAGTTG |
| chr20 | CCTAGTAAAGTATTCAGTTGCTTGACA | CATTTTGTCTGCCATCATTTGCAAA |
| chr20 | TCTTTCAGAAGACCTGGATCCTTTT | TAAACAAATCTTTGGGTGCGCTATT |
| chr20 | CCATTCTTGGAAATCCCATACAGAT | AGGCAATAACTCCAACAGTAGATAA |
| chr20 | TGCATTCTTGTTTTGATGACATCCA | CCTGTGAACAAAAAGAAGACCTCTG |
| chr20 | ACTCTTCAACAAGTAATGATCACCA | GAAGAGACAAATCGAATTCTAGCGG |
| chr20 | GTATGAAACCAATAGCTCTAGCAACC | TGTACTATCTGTGCCATTGAACAGA |
| chr20 | AAACAACAAAGGTGACTGAGAAAAG | CCAAATGGAAAGAGAATTGAAGGCT |
| chr20 | GAAGCATCTTATTCCATGCAAAAGC | TTTGCTGAGATTTTATGTTGCTGGT |
| chr20 | ACAACATCAGGCTTGAGTTTCAAAT | CTACAAAAGCATTTCCAGCAGATCA |
| chr20 | TCCTCTTCTTCTCGTTCATCATTCA | CCAATTGAATCCGCTCTCTTGTAAA |
| chr20 | ATATTGTTCAACTCAAAGGCACTCG | AGGCATAAAATAACTAGCTCCCACA |
| chr20 | TGATTCAGGAATCCTCCAGCAAATA | TCCTGGAAGAAGCTACTGAAAGATC |
| Un\_00001 | CTCTAAGGTGGTCTTCATGTGTCAT | TTCCTTACCTTGATGGAGGATTACC |
| Un\_00003 | CCATTACGGACTTCAATAACAGACC | GGCAACTGTTTAAGGACTCAGTTTT |
| Un\_00003 | AGAGCTGTGTTAATAGTCCAGCTAG | GACTAACTATGACCATGCCAACAAA |
| Un\_00004 | TCTTCCTCAACATTGAAAAGACCAA | AGAGCATGTTTCTTCAGTAAGTCCT |
| Un\_00004 | AGGGCAAAGGATTATGCAAAGAAAA | GTCTCACTTCTTGAAATTGAAATGCA |
| Un\_00011 | TCGACATTCTTGTGCCTATATGTCT | TTGGAGTTCTGGGCATGTTTTTAAA |
| Un\_00017 | AGTGCAGGGAACTTTTGGATATTTG | CACCCTCTTTCAAAACTCGATCATC |
| Un\_00026 | TATAGGAATGGGTAGATGGTTGGGC | GTTATAGGATAATTTGGAACCACCGT |
| Un\_00029 | TCTCTTAACCAAGTCTTTCTGCAAA | TTTAATTTTTAGTTGATAGAGTCCTGTCT |
| Un\_00032 | TGGAATGTGACCAATTTCTGTTCAG | TTGCAGATAAATGTCTCCAGAGTGT |
| Un\_00042 | GCTTAACTGTCGGTCATAGAACATG | CATCAAGAAAACAACGCCAACAAAA |
| Un\_00052 | GAAATGAACCCCACACAACATGAAT | CAGGTCTGTTCTGTATTCTGACTGA |
| Un\_00056 | TCGTTTCACAATGATCCAAAGTTGT | CGGTTCTGAATCACTTAAGCTTTGT |
| Un\_00088 | AGGTAATCAGGCCATTCAAGATGAT | GATAGCGTCTCTCCCTCTAATTGTT |
| Un\_00099 | AAATCTGACTACAGTTTGCAGCTTC | TGAACTATGAATTTCTCCTTTCAATGGT |
| Un\_00100 | GCAACCCGGTAAACTGATGTTTATT | TCAGTGGTTTGTGTCAAGAAAACAA |
| Un\_00143 | AGATCAGGAATTTGAGACAGAAATGT | CTCTTTTAACTTGTGGAGTGGCTG |
| Un\_00146 | GCTAAGCACTGAGAGCAAAGTTTAA | GATCCAAATGACAATGCAGCATTTC |
| Un\_00147 | GGTTTTGTTTGGATGTAGCAATTGG | CTTTGAACATGATCAGACTCCACAG |
| Un\_00178 | AGATTGATAATGTTTGGGCAATGCT | TCCTCATTCAGCCTATTATAGAACACA |
| Un\_00179 | GTACTGCAGATGTAGTGTTTGATGG | ATATCGTTAGCAAGCAGGACTAGAG |
| Un\_00182 | CACTGATATGAAGACATCCCAGGAT | TATTTGTTTGCCATGTCAATCTCCG |
| Un\_00212 | AGGTCCTTATTTCTAAACCCTCAGG | AAAAAGATCTGCTTTGCTCAGGTTA |
| Un\_00226 | AAGATTCAGCACACAATGGGTTAAG | TTGGACACTGATGTTGTTATGCTTG |
| Un\_00264 | GGCAGAGTACATGAGTATTTCTGGA | AATCAGGTCCTAACATCCCATTTCT |
| Un\_00267 | GCTTCCTTGTCTAAGCACTCTACA | TCAAAGAAGGTATGGTGAGATCCTT |