

# Appendix B

## Supplemental Data

The following figures are the full output of MIPS-PT on a dataset of regions of human DNA surrounding 95 known SNP locations.

MIPS-PT Output  
 Primer Size: 20  
 Primer Degeneracy Threshold: 4100  
 Beam Size: 100  
 Pair Fragment Size: 6

Number of Sequences: 190

Primers	Degeneracy	# Covered
GARATMWCWWYWRMAGAAAT	512	2
GAAYATAGTARGSYTTCWKT	128	2
YRTSCATTTATMTTRGASTG	64	2
TCYKSMTSTGAAAYYTRSMK	2048	3
ACYTKKRARTYCCTTHSYST	1536	3
ARRWGGKGCWRGRYSYTGRY	2048	3
CAYWAGSCARGABYWRRKGT	1536	3
GHWGSARYHTVTRTCACCCC	864	3
TCASMTGKMCAWCAMASTSY	512	3
MASCWYMVATYSTGTGKCTG	768	3
CWSTHTCTRMWTCTGYCMTM	768	3
TABAMACHTTYMWCACAKT	576	3
KATTAKTWVTAAYMAATDAW	576	3
AWBKATGCTSWDTTTTGTSY	576	3
CCTYKMACWTWTMWWAASAG	512	3
TRRCTRARAYAAGWYKCAKG	512	3
CCWMYTCTRSTGRSYKTGCA	512	3
CASARAKSAGWGGCMMWGW	512	3
AKMSACAGAKDKBTTTGCGY	576	3
AGMCAGAGGTVRGAKMHKRG	576	3
AWRWTGWAWBRMAAKRITT	3072	4
TTCTTTYKMATWGVRSYCY	384	3
WGKHYKTTYCTSWBHTAAA	3456	4
WWAWCMTAWBCMCASRSA	3072	4
TKWCTGYRDKYYTBTSCCTG	2304	4
WTWAWAHTAWGCAWTKARTA	384	3
GDAKGGGWGAYWYCCCTM	384	3
WGDDRARGAAAKTGAGRVWR	3456	4
WKHAAWARKTYWTMAADATT	2304	4
SCCWKTCTCWTTCAVRCCAR	192	3
WMCCTBYWCMCTCTCKMT	1536	4
WHTCTCCACDYCMDCTSYY	3456	4
AKGRRNAAAGGRAAGWVGWV	2304	4
YASRRTTTHCWHTYTKCAW	2304	4
YTWSAAWTWTTACARHMAS	1536	4
KTTKSWGKTYTTHMMMACTR	3072	4
TAAMAWRRTSAYTGMMDDT	1536	4
AGAVRAGCARARRGRBSWWA	2304	4
WSAAKAWRCYKADGVTTWAA	2304	4
ATRKKRGRMCTKTGGTRRRW	2048	4
CTGVYTKGARRRAMSWCMT	1536	4
ATWWBTWCTKTKGSYMTTTR	1536	4
MMARAACAVAMACASRYVSA	2304	4
MWKBMARAGVAWWTCAWAA	2304	4
CTYYYYWCCHCCCTBYWYK	2304	4
WGTGYTSSSWTWASWGSYGT	2048	4
WTATTBYCMMAMKYTTTSW	1536	4
TAGGCADYVAANAABAWWT	8634	4
TTKARKDAACTWHTYWAAG	1152	4
AWMRARARGRARAAMMRKW	4096	5
WMBATTKTKHDTWTTAWMT	3456	5
TWKTTTDTTDKTHDTBTKA	3888	6
AGACYSTGTYWSHWAAAAAD	576	5
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Total Degeneracy:	84720	

Figure B.1: MIPS-PT output with  $\alpha = 4^6$ .

MIPS-PT Output  
 Primer Size: 20  
 Primer Degeneracy Threshold: 16400  
 Beam Size: 100  
 Pair Fragment Size: 6

Number of Sequences: 190

Total # Primers: 44		
Primers	Degeneracy	# Covered
TGWADWAABTMHYDARKMAA	10368	3
WMMKCYCADCTRDSTKCYTS	9216	3
AARYCWKSAABATWKTADKS	4608	3
CMYSRWRTCCWGSYTCCCWG	1024	3
BMTBTSAAARGSAACYRYWCA	2304	3
WSMHAKMCCTWBACTGTHCA	1728	3
ASMWCYTBHTSTKAAATTWG	1152	3
KKRDDGTGDGTRARMRKRAA	13824	4
ARTASSWDRHGDRRGWTCMC	13824	4
TYMAWRACTGWKDYMWKGTK	12288	4
TDWTAGAAAANRMAADDWYTW	6912	4
CTCTYWBHWGYTGTKDTCYW	6912	4
TKTNRSDKATGAGAGDRVWG	6912	4
ASTYTCWWSAYCAKMMMWWY	8192	4
MWGCYTCTKBCMWHYWCABA	6912	4
CCWMYTYWRSTGRVYKTCGW	6144	4
AMWYKWAAGAAHDTSTTMY	4608	4
TRAAWYYSTYTMGTGWBWTW	6144	4
TTCTYYKMWYWGVRATBYC	4608	4
MAYTGMTTWTGHRWWWTKWA	3072	4
YHTMATCWKMTKTYWYWTFT	3072	4
ASACAKARGKVASRDCYWRG	4608	4
SYCWKYCTCHTYCMVRCCAR	4608	4
AKTAABTWWTATYTSYWYWW	3072	4
KBTWAAAYAGWTTADGWHWWT	3456	4
SCCAKWCWCWGADWYTTTB	2304	4
YWMCMCTBYWWCHTCTCYM	9216	5
KGDAKKGRSWGAYWTYCYTT	3072	4
YTASRRTYTHCWHTYTBAYW	13824	5
AGAVRAGCARARRGRBSWWA	2304	4
CTGVYTKGARRRAMSWCANT	1536	4
WAAMAWDRTSAYTGMMDYT	9216	5
WRWGYTSSSWTWABWGSYGT	12288	5
GRDGAABKKARRBTKTAWD	10368	5
SCTKNYYWYCWCMYCTVYCA	12288	5
ATWWNTWYTKTKGBHMTTTR	9216	5
TYMTTYARAHWSAWRRYAWA	6144	5
MMMVAACAVAYRMASRSVCA	13824	5
TTKADKDAWMTTWHTYAWAG	6912	5
KAKGMAATBARDRMHDAAVT	15552	6
WMBATTKTKHDTWTYYAWMT	13824	6
AWMVARARSRARAAMAMRKW	12288	6
TWKTTTDTTDKTHDTBTBKA	3888	6
AKWYYTCTYTCHWAAAHWD	13824	7

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 Total Degeneracy: 321456

Figure B.2: MIPS-PT output with  $\alpha = 4^7$ .

MIPS-PT Output  
 Primer Size: 20  
 Primer Degeneracy Threshold: 66000  
 Beam Size: 100  
 Pair Fragment Size: 6

Number of Sequences: 190

Total # Primers: 36

Primers	Degeneracy	# Covered
TGCTATGCCAGGTGGCCAG	1	1
YHYAGTWTMAAWBKRYWRMA	18432	3
TDABRMMRYTTTMMWTKATSA	4608	3
YMYMCMTTBYBSHRHYAACT	41472	4
WHTVWCCWHYYKBCTSTSAG	20736	4
SMRABCWNHTBWACAKRWWT	55296	5
DATGRHTRTCYTBWTBHABT	11664	4
YTVWGDGKARKAAMDTSAVA	10368	4
CTCTYHBHWKYTTGBDTCYD	46656	5
CASAVAKVAGGHRGSHHRW	46656	5
HGTSDVSWKGRARGVSCYSC	41472	5
TTBCYDTWCYMYWWHWMABC	41472	5
RTKTGAWKWRNRTGDRWWTR	24576	5
YTSDBAGCHARRSSWWSKWG	55296	5
MDGGARRCCTBYKSMYWYMW	36864	5
SADRSTRASTKYTYCCHDRW	27648	5
MTTCAHSMHTWRRWTKDRSA	27648	5
TSTCTKYDKKMYBTVCCTK	13824	5
KHAMWWWRTAHKAARMWKTT	18432	5
WDCWKHTYTMTYTMAAWDYH	41472	6
RWWTYHAHWRATATWWHKTB	41472	6
WWWCCCTBYWWHMTMTCWKNT	36864	6
TKMTRKTYTBVAWAWMTDKS	27648	5
CTGVYTKKARRRAMSWYMHT	18432	5
WRADDWKCMAAABKSBAAV	62208	6
TMWCANTGDTKMYKNDADTT	27648	6
WWHWNTHYTKTDKGWMTTTR	55296	6
MHADAHMAVWCAMAVRCNSA	62208	6
WDYYMCMYTCCHVCYWSHCC	41472	6
MYTKYAVWKDAWWWYAWWAA	36864	6
TYBAWKKADCHTRCWTHWWK	41472	6
TATTNBCAMAAHBTWYTVHH	23328	6
WNVANTKHRAKWWTKTADAT	55296	7
AWMRRRARGRARWAMAHDKW	36864	7
TWKTYDYDTTDKKHTNTNTKA	55296	8
AKWYYTYKYTYHWAAAHWD	55296	9

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 Total Degeneracy: 1.26226e+06

Figure B.3: MIPS-PT output with  $\alpha = 4^8$ .

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MIPS-PT Output
Primer Size: 20
Primer Degeneracy Threshold: 262200
Beam Size: 100
Pair Fragment Size: 6

Number of Sequences: 190

Total # Primers: 29
Primers      Degeneracy  # Covered
KKRWAWAMTDYWSAARDMA 36864      3
STHTTGKGGKVVKKYWBYY 110592     4
YWYYWDCWKHRAWMHYTKSA 221184     5
MMARDAHBWGAWKYVRGTD 124416     5
GASDDRSHAVRKGMTBHYAG 93312      5
CWGKASRHAGNSYDDGVMST 82944      5
ARHWDWTWKYWCKSMTTYBT 55296      5
GMVDCWRRDAKGWVRMGGVH 186624     6
RYHWSMWTKKHTATKWBDT 165888     6
KBHDTTTTCYDYWCHYWKNKG 248832     6
MTGWWTSTSHMHWASAHDNR 165888     6
HHVVMWSHTHCCYYTCTDHT 209952     6
WADKARMATBKYHBWTBSAY 124416     6
ASAMADWRRKVANVDCYWRG 165888     6
AKTAAYWWHDHTTTNNWSNW 221184     7
GTGDGCYACHGHNYVDDKYY 93312      6
WHHAWRHYYWGMMAWKANTW 221184     8
YVKGDNBCTMMSYYTCHTSH 248832     7
BNNTKVTKKTCTBVAWRDMT 248832     7
WRSKKKBARRKAWGMBWBTS 221184     7
WHAWMBHHTKTKKSYHTWTG 124416     7
DSNAKDGRSDGANWTYYTK 221184     8
WTWMWTYWRAWVRRRHW 147456     8
HMMNAMCABAYDCHSRCVCA 62208      6
WDYYMSMYTCCHVSYWSHCC 165888     7
WRKHHWTBAWRNWADWAATD 248832     9
AWMVRRARSRARWAMAHDKW 110592     8
HHBWTTNDKWDTWTTTWRW 248832     10
WNWBYYTBTYTYHWAAAHWD 248832     11
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Total Degeneracy: 4.82487e+06

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Figure B.4: MIPS-PT output with  $\alpha = 4^9$ .

MIPS-PT Output  
 Primer Size: 20  
 Primer Degeneracy Threshold: 6600  
 Beam Size: 100  
 Pair Fragment Size: 6

Number of Sequences: 188

Primers	Degeneracy	# Covered
GWGGKCTRGGTGTGRGAG	16	2
TATGAATWTMBTKATKHAKT	288	3
TATGAATWTMBTKATKHAKT	288	3
TATGAATWTMBTKATKHAKT	288	3
CWSTHTCTRMWTCTGYCMTM	768	3
AWAYRGAGHRWWRAAAAAA	768	3
ATAAMWTGRRAGSMAMRTVA	768	3
CCWYDAACWTTTMMWKAAYAK	768	3
CMRCACRAAKMAGGWGRGMW	512	3
YWARAGGAWKAGCTRTGBTS	384	3
MRGTAWSTTBATAAKMTCT	384	3
SWKTTTCYKYTSMCWKKGGM	4096	4
AMTCTSSCMRDKRWMGTGRY	6144	4
MYHTTTTWYWKHAARAWMTG	4608	4
WDWSTGWKTGAVCWKGRASG	4608	4
RWATGHMATATTKTWRATBH	1728	4
ATWTRSYTWBCKAKTTSHAM	2304	4
GGAWMATRABVAYATBRAWS	3456	4
AMWYKWKGAHDTSTTMY	4608	4
ASACAKARGKVASRDCYWRG	4608	4
WGTWYBTTTMMWKAHTDTAWA	3456	4
RTBCYSWDTBTAWAAATRYA	3456	4
RGMWYTTTSMCKWWSMAGM	4096	4
CMYAGWCTSWYYSARRSCAR	4096	4
TRRATTYTBBDCTGWTRWM	3456	4
TGWAWTYWTWDATATHWWKT	2304	4
YWWWAWAMWAWKVATTTART	3072	4
AGHMAWVRTTMWYAMAAAYY	3072	4
TWYAAWTARTKACWDVWCD	3456	4
ARMTTTTYTHHTSAHTWTB	2592	4
YTASRRTTTHCWHTYTKCAW	2304	4
WACCCTBYWWCHTCTCYMK	2304	4
KTKKSWGKYTTTHMMACTR	3072	4
RTAAMATWKKCCCHSASRBA	2304	4
TAAMAWRRTSAYTGMMDDT	1536	4
CHCHCARGYCASYTWYSWTT	2304	4
AGAVRAGCARARRGRBSWWA	2304	4
ATRKRRGRMCTKTGGTRRRW	2048	4
ATWWBTWCTKTKGSYMTTTR	1536	4
CMADAMMARWCAMARRCNCA	3072	4
MTKKMARWGRAWDTCATWAM	3072	4
TTWHWTTAAAWMMRWGRWWW	6144	5
MTCYYCMYTCYHDCCWCYCC	2304	4
TYTBYWWAMTGTAAADRMM	2304	4
TTTTYYCWMKYWWMCCTTTW	2048	4
TTKARKDAACTTWHYAWAWG	1152	4
AKSHAATKAVDAAWDRAAWG	5184	5
WMBATTKTKHRTATYYAWMT	4608	5
AWMRARARGRARAAMAMRKW	4096	5
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Total Degeneracy:	128144	

Figure B.5: MIPS-PT output on masked input set with  $\alpha = 4^6$ .

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MIPS-PT Output
Primer Size: 20
Primer Degeneracy Threshold: 16400
Beam Size: 100
Pair Fragment Size: 6

Number of Sequences: 188

Total # Primers: 42
Primers      Degeneracy  # Covered
ADAYRGARHDHWWVAAAAA  7776      4
RAANAMWAAATGRSSRHVS  9216      4
TATDWCWKWYTWATVMH    13824     5
ARGMYATSAAANBWMYTKT  6144      4
KMRADGGRHAAARGRAWGAV 3456      4
YTKVCCTVTGTGNSDCCBBT 7776      4
YTWVTRAMYWYCTTTMTVTH 6912      4
RCARAASSAWBWGYKDTGDT 6912      4
CTRWWTSTSYCYWAGANKHA 6144      4
WRCMCTSHTWCYTCTSYMK  6144      4
WDWSTGWKTGAVCWKGRASG 4608      4
ASACAKARGKVASRDCYWRG 4608      4
GKDMYCAKKTADAWMTGCW  4608      4
YABAWHKWDTYTTMAAAAW  3456      4
GGAWMATGWBSACA SVMWS  4608      4
WWYTDWTWTKMRTTWTTTA  3072      4
WRHATKYAYRAATATMWTKW 3072      4
RAYYTCTBCCA KTM MYRR  4608      4
CMYAGWCTSWYYSARRSCAR 4096      4
AKTAAYTWWKWTKKS YWCWA 4096      4
WTWYTT HAWAWVAWKDTKWA 13824     5
YTWCADWTWATTWHWAAMAH 3456      4
WTTWVTMWCTYVATATYAYK 2304      4
AGAVRAGCARARRGRBSWWA 2304      4
MWWWAWAMYRWGMATYWMRT 16384     5
KGDAAKGRSWGAYWTYCYTT 3072      4
TMTKTGKKTMKDYRCHTBTS 13824     5
WTWTHYTDWYTTAWAAHWW  6912      5
CHCHMARGHCABYTWYVWTT 15552     5
TTKYDKKDCWTHAAAAYTDK 10368     5
TGGKGHCYVHRKYTYWSCYC 13824     5
WTWWVTWYTKTKGKWMTKTR 12288     5
RDAACATWTKYSMMM AVRBA 13824     5
TYTHTCTYTYTDDAYYK WYT 6912      5
TTWHWTTAAAWMRWGRWWW  6144      5
TYTBBWWAMTGTAATWDDMH 15552     5
HTTDMRDARRAWWTMATWAA 6912      5
CTKNYYWYWC MYCTVYCAS 12288     5
TTKADKDAWMTTWHTY WAWG 6912      5
AKSHAATKAVDAAWDRAAWG 5184      5
WMBATTKTKHRTATYYAWMT 4608      5
AWMRARARGRARWAMAHRKW 12288     6
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Total Degeneracy: 319872

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Figure B.6: MIPS-PT output on masked input set with  $\alpha = 4^7$ .

MIPS-PT Output  
 Primer Size: 20  
 Primer Degeneracy Threshold: 66000  
 Beam Size: 100  
 Pair Fragment Size: 6

Number of Sequences: 188

Total # Primers: 34

Primers	Degeneracy	# Covered
GVBRRAWRDHTRHSCTKTST	62208	5
AGBABVTTRRMWVTDCTWB	46656	5
YNSHRCAMVAAKHAGRWRRC	55296	5
YWTKBAYTKDYRAMTKYMTK	36864	5
CHRKGMWAADBRCARWST	41472	5
KBBTYTWAAAARMTBWKBYR	41472	5
CASHSWSRBTSSAGCHTBMVA	31104	5
TBTTHMWTGMAYKTKDMWYW	27648	5
AAVVRMTGWKSYVKKDTGGK	27648	5
AAADHYDDNDCMTTNMAAAT	31104	5
RKDMBCAKKRKADAWMTGCW	27648	5
HAHTRDTKYWGHRTHTKTM	62208	6
AMAARYAVMYHTMTKHHTKT	20736	5
WWTTRMWARHATKHHTYTNMA	36864	6
YTWBMATWWWTTABARDMAB	20736	5
RVARDKWWGDARAAARBVA	62208	6
YWWWAWWWWKKNATYTRRT	65536	6
DAAMATHWBCMCWKGKVK	20736	5
CCYASTSTSWYBMARVSMMG	18432	5
GMCWKDGHWCGRDDTBTTK	15552	5
RGARRDGBADAARGRNWVDA	62208	6
TMNNWTTTHMWHWSTWCAYA	36864	6
TTKBDKDNYPHAAAAYTRK	62208	6
WTDKWDKAHTDWRGWAAAW	62208	6
WKSkgwctGHRDTYYTSHBC	41472	6
WTWVWVWYTKTKGKWHKTR	36864	6
SNAKKGRSDGAHWYTYTTV	55296	6
CTKNYYWYCWCMYCTVYCAS	12288	5
THTBTSTYTYTDNAYTWYY	27648	6
TYTBHWWWMTGKAADRMH	41472	6
ADVHAATKAVNAADDRAAWG	23328	6
WHBATTKTKHRKATYYMWT	27648	6
TTKADKDAWHTYWHYAWWG	20736	6
AWMVARARSRARWAMAHRKW	36864	7

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 Total Degeneracy: 1.29923e+06

Figure B.7: MIPS-PT output on masked input set with  $\alpha = 4^8$ .



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MIPS-PT Output
Primer Size: 20
Primer Degeneracy Threshold: 262200
Beam Size: 100
Pair Fragment Size: 6

Number of Sequences: 188

Total # Primers: 28
Primers          Degeneracy  # Covered
GKDMYCAKKRTADAWMTGCW  4608        4
WTDYCYTKHHYTTWDVHWA  186624      6
VMADKAMHHATKRHAGWDNT  186624      6
AWARHHWWRDMRTTNHMART  165888      6
AWYTBHBHTWKMVYWWTYTA  124416      6
TWDRHANRMAWTATTNYMRM  73728       6
VNDRGVAAARDGMWCWBWKS  248832      7
TDWWTKNRHRAANWKAATDW  221184      7
BVADMMYBYTHCCCAMMYSH  186624      6
BHHHWVTTBAKAWKMTSTSK  186624      6
AKHAWHTTKYMDWTBNMCWR  165888      6
NWSWWWTTWWDKAMWAAMAH  147456      7
ADBTWTWTNCAKYWADHDVW  186624      7
CYTBHYHYSSWYCCCWVHCM  82944       6
YWWDAAWMMWHWKNATBTRRT  221184      7
ATWTYHTDWHWHYWRNAAHA  124416      7
DAAMAYHQBMMCMCWKGKVK  82944       6
WABVDTTTMMDHTYTMMWWW  124416      7
CMCAGWBKNWHKVARRCMHR  165888      7
ATDKKRGRMMYNKGGKRRVW  147456      7
WTWDVWDYTKTKGKHTKTR  124416      7
DSNAKDGRSDGANWTYYYTK  221184      8
MYTKHANWKDAWDWYAWWAA  110592      7
HBSKGWCTGHRDYYTSHBC  93312       7
TTKHNDDAWMTTWHYYHAWR  248832      8
RRSNRAKGRDDAARKRRAWS  147456      8
WHBATTKTKHRDAWHYHWMT  186624      8
AWMVWRARSRARDAMAHRKW  110592      8
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Total Degeneracy: 4.27738e+06

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Figure B.8: MIPS-PT output on masked input set with  $\alpha = 4^9$ .