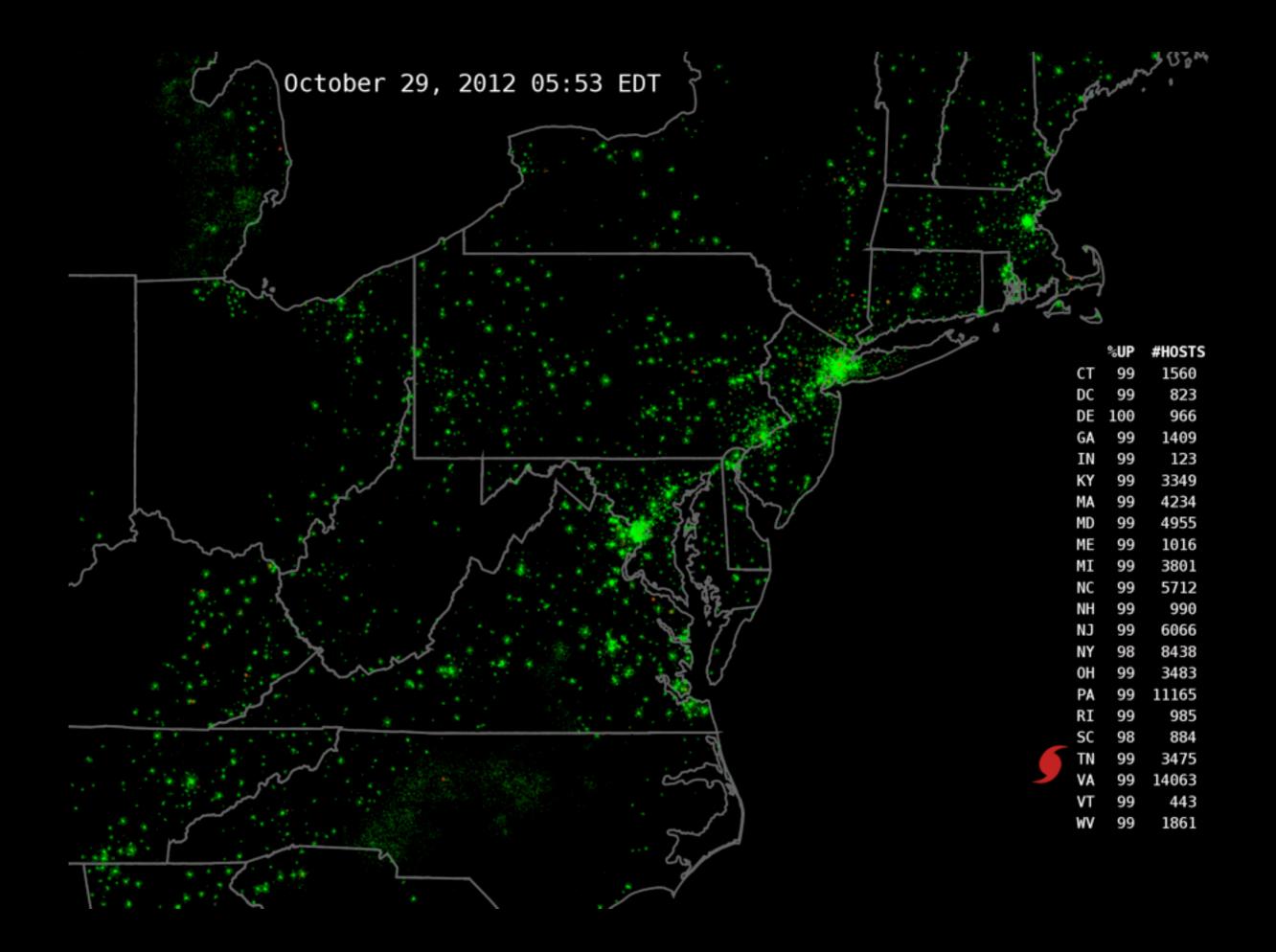
Pingin' II: Now we're Analyzin'

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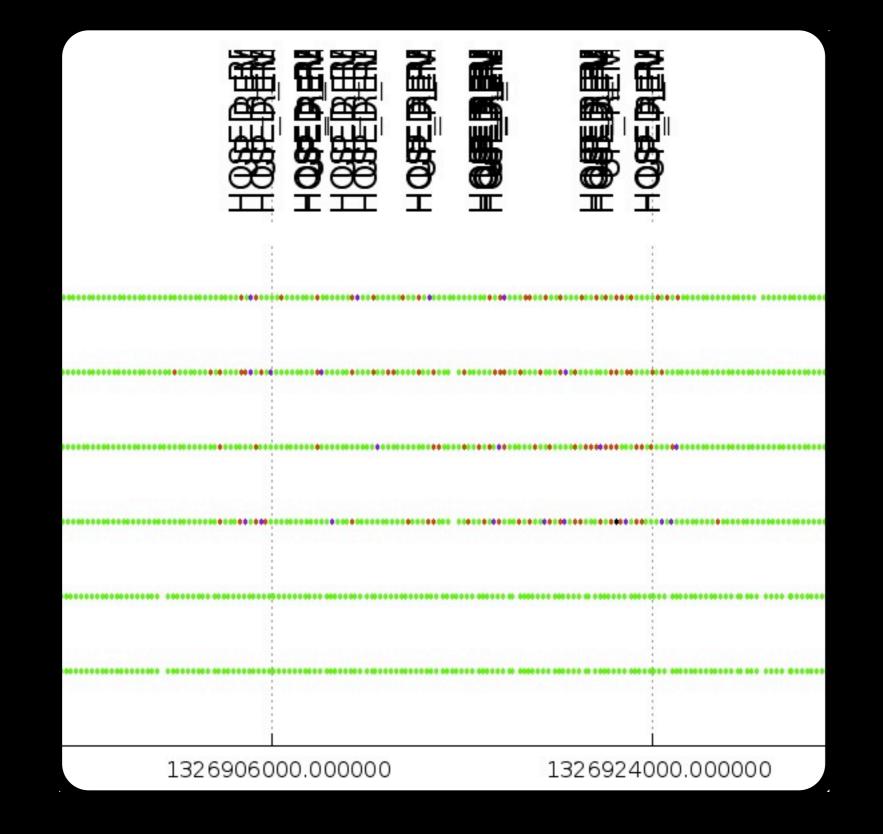


Problem

How do we reduce pings from (to) many vantage points to a responsiveness state?

UP DOWN HOSED

Loss rate in a window is too noisy

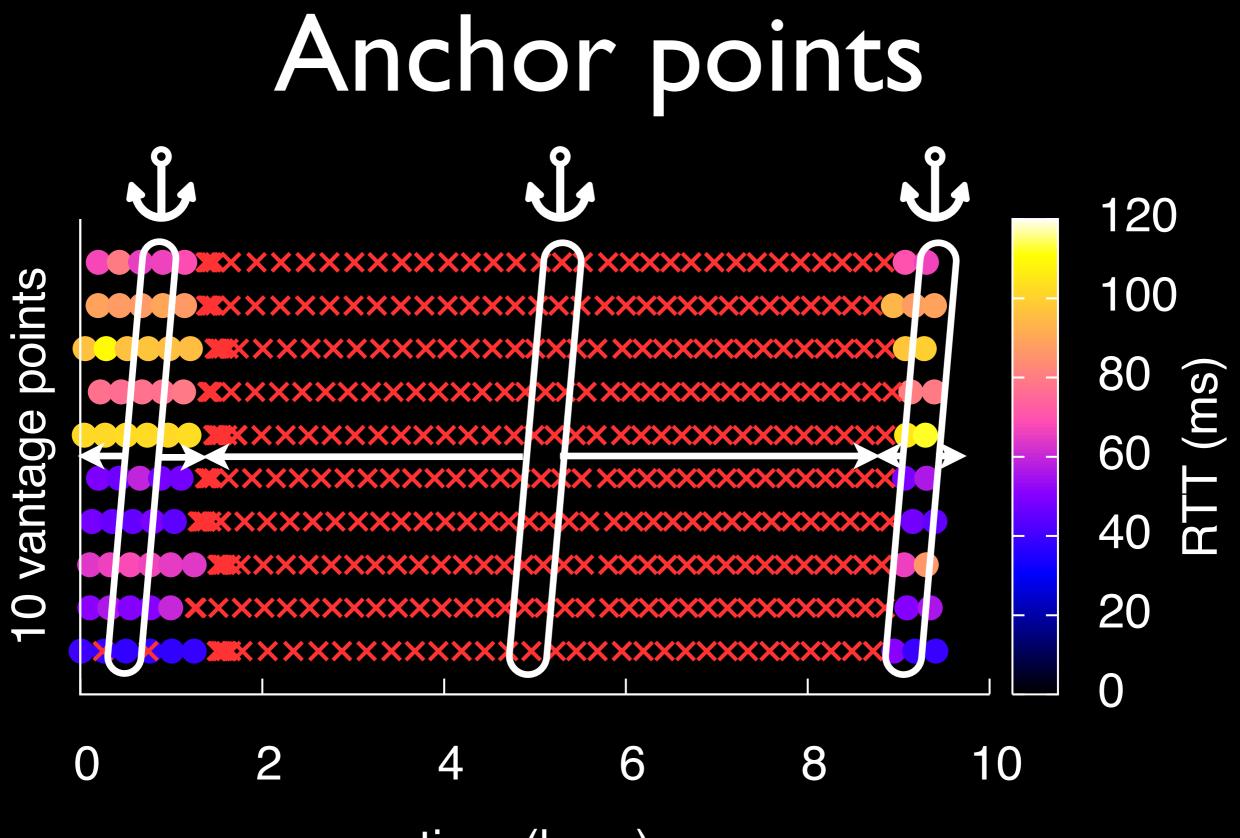


New way to determine res. link state

I. Find anchor points [all vantage points agree UP or DOWN]

2. Grow out from the anchor point (Lex & Yacc)

3. HOSED is whatever remains



time (hour)

UP 8(13) IJABCDEFGHHIHJCABFDEG -- FHCGJBAEDHFCGJBAEDHCFGIJBAEDII -- HJDABECFGDOWN 37(15)UP 6(1)IADHJ DABECFGIHJDABECFGIHJHDAHBDHADEBCABDFEACBIGEHCFDDOWN 42(7)UP 8(2)IJDABECFGIHJHHDABECFGDOWN 28(5) UP 8(2) IHJDABECFGIHJDABECFGIHJHDABHDEAHCFGDOWN 32(6) UP 8(2) IHJDABECFGIHJDABECFGIHJHDABECFGIHJHDA ABECFGIHJHHDABEDCAHBFEDCGABFEHCDADOWN 39(8)CHFGIBAHJEDABECFGIHJHDAHBDAECHFGDOWN 32(6)UP 8(2)IHJ DABCEFGIHJADBECFGIJHDAHDBAHCEDHBAFCEBGDAHDOWN 37(7)UP 7(2)IBHJDABECFGIHJHADBCEFGIHJHDHABDHABCED AFBCEHGDAFBCEDOWN 38(7)UP 7(1) IBHJADBECGFIHJHDABHECFGDOWN 24(5)UP 8(3)DOWN 26(5)UP 8(2) IHJDABEC FGIHJDABECFGIHJHDAHBDHAECFGDOWN 30 (5) UP 8 (2) IHJDABEFCGIHJHDABECFGIHJHDABHDECFGIHJDABCEFGIHJADBC EFGIHJDBAECFGIHJDABCEFGDOWN 31(6)UP 8(0) IHJDBAECFGHIJHADBECFGDOWN 43(8)UP 8(4) DOWN 31(6) BEIHD CFGAHJABECFGDIHJHAHBECFDGIHJHADHBADECBHDABECFGHCFEADBIHJIHBADCFHBAEDGABCFHDOWN 36(6)UP 7(3)JBAE CDIFGHJBACFEIGDHJHABCFEDGIHHHJABFCEDGIHJABCFGEDI - HJDABECFGIHJABDECFGHJADBECFGIHJHDABHDEABCHDEF GII--HJHDAHBCEFGI--HJDBACEFGIHJDABECFGHJIADBECFGIHJHDABECFGDOWN 9(14)UP 8(1)DOWN 30(7)UP 7(1)H JDBACEFGI-HJHDAHBCEFGIHJDABECFGIHJHABHDACEFGIHJDABCEFGIHJDABECFGIHJDBAECFGHJHDHIABECFGDOWN 42 (18) GDABIHJECDFABECFGI-HJDABECFGIHJDABECFGIHJDHABHDEACBDFEHACGBDOWN 32 (10) DEABFGICEHHJHDABECFGI HJHDAHBDEACBHDFECABGHCFADEBIHJDABECFGIHJDBAECFGIHJHDABECGFDOWN 24(11)UP 9(5)JDABECFIGHJDBACEFGI HJHDBCAFEGDOWN 20(9)UP 8(0) IHJBEDCAFGIHJBEACFDGIHJHAHBAEDHCFGDOWN 31(8) ECDFIGBAHHJDABECFGIHJADB CFGIHJHDAHBADBEHCADFBEGHDOWN 37 (12) UP 9 (3) JDABEICFGHJHDIABCEFGHIJHHDABCHEFGHHIJHBHCABEFDGCAEFH DBHJBIHCEFDGA--HJBCEIFGADHJBECFGAID--HJABECFGDIHJABECFGDIHJABECFGDDOWN 14(22)UP 8(7)JECADBFIGHJ HHHACEBFDHCA<mark>EGFBDCA</mark>IH<mark>- DOWN 35 (9) EGHJCBAFEGD</mark>IHJH<mark>HBCFAEGD</mark>IHJDABECFGIHJHAHDBEADBCHFEAGDBCEFHA</mark>IHJA DBEFCGIHJDACFBEGIHJHADBCFEGIHJABDCEFGIHJADBEFCGIHJHADBHAECFGIHJHDABCEFGIHJADCFBEGI - DOWN 20(4)U P 8(1) IHJADBECFGIHJABDECFGDOWN 42(31) DGIABECFHDOWN 32(6) UP 8(1) IHJDABCEFGDOWN 36(17) UP 8(2) IHHJ AHDBECFGDOWN 32(6)UP 8(1) IHJADBECFGIHJDABICEFGHDJABCEIFGHJDABCEFGIHJBCFGEDADOWN 20(12) AIHGCEDFB DOWN 37 (7) UP 8 (3) HHJBFCEGDADOWN 39 (22) GAIDCBFEHHJHBHEBCHDFECBGAIHJBECDFAGDOWN 7 (15) UP 8 (1) I - HJ HAHBAEBCHFGDI-HJDABECFGDOWN 31(17)UP 8(2)I-DOWN 21(5)UP 8(0)IHJDABECFGDOWN 27(17)UP 7(1)IHHJD ABECFGDOWN 36(11) FEBAICGHDDOWN 36(7) UP 6(1) IBDDOWN 28(7) FGECHDABHADBHABD DOWN 7(2) UP 8(1) IHJDA BECFGIHJDABCEFGIHJHABDHAEBDCEAHBFGDDOWN 30(7)UP 8(1) IHJHDBAECFGDOWN 18(6)UP 8(1)DOWN 36(9)UP 5(1) IHJFGBDAFEBCGIHJHHHDHACFGEBI--HJHAHBAECFHDGDOWN 30 (8) UP 8 (2) IHJABCEDFGIHJBACEFGDIHJHBHAABEFDC HBGEADOWN 34(8) BDEGCFHIDHAJABDECFGIHJHAHDBECFGDOWN 24(7) UP 8(1) IHJADBECFGIHJADBECFGIHHJHDABGFCE DOWN 18(8)UP 8(1)DOWN 40(11)UP 5(1) JBACBACEFGDIHJHABHAECFHGDDOWN 27(9)UP 8(2)IHJABECFGDIHJABCE GDIHJHHABEHCABFEGABHDIHJHBHAECHABEFGACFEBDHIHHIFJECGBADHHFJGCHBIFEAGCBHAEFCGDEBFDOWN 32(6)UP 6(4) JFBCGEAIDHFJCGBAEIDHJCFBGAEIDJHCBAFGEIDJDHABCEFGDIJHABCEFGDIHJABCEFGDIHJABCEFGDIHJHAHBECFGDDO WN 26(8)UP 8(2) IHJABECFGDIHJBAECFDGIHJHABHECABDFGIHJHBDAECHBADFGIJHBADCEFGI-DOWN 13(3)UP 8(1) I --HUBAEFCGDI--DOWN 16(4)GBFDECAHBDOWN 40(21)UP 8(2)I--HUABEDCFGIHUHABEFCDGI--DOWN 30(6)UP 8(2)D OWN 21 (25) UP 8 (1) I-HJDABECFGIHJDABECFGDOWN 35 (27) UP 8 (2) I-HJHADBECFGDOWN 37 (20) CBHIEGFADHJHDA HBEDAHCFGDOWN 28 (8) UP 8 (2) IHJDABECFGIHJHDAHBDCEABFHDGDOWN 33 (10) AFBDIGECHHJDABECFGIHJHDABECFGIH ~~<mark>KKK~~KK~~K~~KKKKK~~KKKK~~KKK~~K~~DOWN 9(4)M~~DOWN 16(9)UP 167(148)GDGUP 46(40)HUP 195(204)HHUP 19(1</mark> 5) DOWN 54(8) UP 152(150) DOWN 51(8) UP 29(18) DOWN 37(5) UP 10(2) DOWN 36(6) UP 21(13) DOWN 15(3) UP 10(1) HHJHJCFUP 62 (56) GUP 137 (137) DOWN 48 (8) JFUP 19 (6) DOWN 11 (2) UP 9 (1) DOWN 34 (6) UP 39 (32) DOWN 37 (7) UP 18(8) HUP 19(17) DOWN 22(4) UP 29(23) HHJUP 40(32) DOWN 15(3) CBDAFLHGMJDHDUP 21(16) DOWN 17(3) BAU P 49(45) HHJJDHLDJBDAHCFGMHUP 10(4) HUP 29(35) LLHHLJHCGFBAJMLUP 44(40) LUP 58(49) HHJUP 168(175) LLH HJLHJDUP 40 (35) LHHJJDLHDUP 10 (3) DOWN 40 (6) BFACGHLMFJDHUP 212 (229) UP 20 (15) DOWN 42 (6) UP 30 (20) DOWN 18(3)UP 40(34)DOWN 34(4)UP 30(22)HHJHJDJDHUP 10(3)DOWN 42(5)UP 30(21)DOWN 16(2)UP 10(2)DOW N 46(6)UP 17(8)GUP 23(22)DOWN 51(8)UP 60(51)HHJHJDJDHUP 10(3)DOWN 24(3)LCUP 29(23)DOWN 16(2)LDB AHUP 16(12) DOWN 12(3) CHUP 29(23) DOWN 21(3) UP 30(19) DOWN 33(4) UP 30(22) HHJHJDJDHUP 10(3) DOWN 42(

KUQ<mark>GGDU</mark>BBGVUDKDGQGUTDBBVGUKGQDGUDTDBBGVGUKGDDQUDBTBVGGUKGUDQDBDBTDDDVUQKDDGGUDGBTBDDDKVTUQUGGB BTDDKDVUQUGGBGBTDDKVDUQUGGGBBTDDKDVUQUGGBGBTDDDKVUQUGUGBGBDTDDKVUQGUUGBGBBTDDKDVUQUGGGBBBTDDDK UQUG<mark>UGG</mark>BB<mark>BTDDKD</mark>VUQG<mark>UGG</mark>BBBTDDDKVUQUG<mark>UGG</mark>BBBBBTDBDKDVUQG<mark>GUG</mark>BTDDKDVUQG<mark>UGG</mark>BTDDDKVUQG<mark>UG</mark>BGDTDDKVUQGU BDTDDKVUQGUGGBTDDDKVUQGCUBGTDDDKVUQGUGGBTDDDKVUQGUGGBTDDDKVUQUGUGGBGTDDDKVUQUGGGBGTDDDKVUQUGGGBC TDDKVUQUGGGBTDDDKVUQUGGGBTDDDKVUQGUGGBTDDKDVUQUGGGBTDDDKVUQGUGGBTDDDKVUQGUGBGTDDDKVUQUGGGGBTDDD^K VUQUG<mark>GG</mark>BTDDKDVUQUG<mark>GG</mark>BTDDDKVUQGUGGBTDDKDVUQGUGGBTDDDKVUQUGGBGTDDDKVUQUGGGBTDDKDVUQGUGGBTDDDKVUQU DOWN 17(6) DUGKGLKKKLDKTVDUUKGBGLDKVDUUGKGBLDKVDUUKGBGLDKVDUUKGBGLDKVDUUKGBGLDKVDUKGBGLDKVDUKUGBGLDKVDUKUGBGLDK DVUUKGBGDLKDVUUKGBGLDKDVUUKGBGTLDTKDVUUKTGBGTLDDKVUUGTKBGLDKDVUUKGTBGLDKDVUUKGTBGLDKDVUUKGBGTL^L KDVUUDOWN 17(16)UDOWN 9(9)UDOWN 8(8)UDOWN 9(10)UDOWN 7(9)UDOWN 10(9)UDOWN 10(9)UDOWN 10(9)UDOWN 10(9)UDOWN 10(9) DOWN 10(9) DOWN 10(9) DOWN 10(9) DOWN 9(9) DOWN 9(9) DOWN 14(11) DOWN 11(11) DOWN 8(9) D OWN 9(9) UDOWN 10(9) UDOWN 10(9) UDOWN 10(9) UDOWN 10(9) UDOWN 10(9) UDOWN 10(9) UDOWN 11(10) UDOWN 9(9 UDOWN 12(10) UDOWN 8(9) UDOWN 11(10) UDOWN 10(10) UDOWN 9(9) UTKGE DOWN 53(55) SITDOBFGVU -IDEBO SVU-DOWN 10(2)UP 7(0)DOWN 8(2)GVBTQSDUTLFGBVDUGQBVDUQSTTLFGVBGUDQVBUDQTSTLFGGBVUDQBVUDQTSTLG GVBUDQVBUDQSTTGFLTGVBUDVQBUDQTSLFGGVUBDVQUBDQTLSGFGVVUBDQUBDQLTGFGSVUBDVQUBDQGLFTGVSBUVDBUQDQLF UUBSDBQDQQQLTQDDBQBFGGSVQVUUTLDDQBBFGGSVVUTULSTDDQBBFGGVVUUDOWN 7(20)DGBVGUVUDOWN 7(18)DG VBVUUDOWN 10(6)UP 5(0)DOWN 9(5)GTVUDBSGFVUGLBDVQUBDTBSGFVBGUQLVDBUDTSGFVGLBUVQDBUDTGFVSGLUBDVQU BDTGFVGULSBVDUQBDTGFGVULBVQUDBSDTGFGVLUVBUDQBDSTGFGVLVUBUDBQDSTGFGVLUVBUDBQDSTFGGVLUVBUBDQDSGF TVLUVBUVBDQUDVUVUGFSGVTVLUUBBDQDVVSTGFGVLVUBUBDQDSTSGFGVLUVBUBDQDTGVSFLGVUBUBDQDTGFVLGSVUBUBDQD FGTVGLUVUBSDBDQGFLTGVUVBUBDSDQGFGLTVUVBUBDQDSGFGLVUTBVUBDQDSGFGLUVUBVTBDDQGFSGLUVUBVTBDDQGFGSL VÜBVBTDDQGFGLUVSUVBBDTQDGFGLUVUVBBSDTQDGFGLUVUBVBBDTSQBDGFGGLGUVBUVGDDQTGSGFLUVUBVGGDDQTGFGSLUV UBVDDQTSGFGTSLUVUBVDDQSGFGTLUVUBDVQDSGFGTLUVDUBQVDSGFGTLUVUBVDQDGSFGTLUVUBVDQDGFGSLUTUVDBVQDSTS LDQDBFGVGUVULDQDBFTGVUGVULDQDBTFGVGUVULDTQDBFGSVGUVULTDQBDFSGVUGVUTSLDQDBFGVUGVUTSLDQTDBFGVG^U VSULDQDSBFGVGUVUUTSLDQBDFGGVUVSUTLDQSDBFGVGUVUTSLDQDBFTGVSGUVULTSDQDBFGVGUVUSLTDQDBFGVGUVUSLTDQ DBFGVGUVUSLTDQDBFGVGUVUSLTDQDBFGVUGVUGGGSLTDDQGBFGVVUUDOWN 12(15)VUDOWN 9(9)VUDOWN 11(13)VUDOWN 10(6)VUDOWN 9(6)UKVDOWN 10(6)UVDOWN 8(5)UDVTSLKGBUUVVDTKLSBDKTGVVUUKLTDSBKGVVUUKLTDSBKGVVUUKL DSBKGVVUUKLTDSBKGVVUUKLTDSBKGVVUUKLTDSBKGVVUU~~BGSBGQGKBSBSGGGQGQBBSDKDSGDGGQQDBBDGGSSSKSGGQ SQQSBBDGGSSGGQKQTBBGDGSGGSQQBTBKKGGDKGGSSQQBBTGGDKKGGKQSQSBBGTGDGGGGQKKGQSBBKGTDGGQQBSBGKKTDKGG QQBBGSTKKDGGKQQBBGSGTDGKKQQBKGBBGSGTQQBKBGKSKGGTSQQGBBKKGGKSTQQSGBBGGKKQSTQGBBSGGKQKQGTBKBGGSQQ DOWN 10 (13) DOWN 98 (170) - GLFVKBJODGLFVKBJODGLFVKJBOBODGLFFVKJBOBODGGLFFVJBOKBOGDGLFFVBJOKBOGG DFLFVBJQKBQGGLFFDVBJQBKQGGLFFDVBJBQKQGGLFFDVBJBQKQGGLFFDVBJBQKQGGFLFDVBBJQQKGGFLFDVBBJQQKGGFLFDVBBJQQKGGFLFV DBBJQQGKGFFLVDBBJQQGGKFFLVDBBJQGQGKFFLVBDJBQQKGGFLFDVBJBQQKGGFFLDVBJBQQGKGFFLDVBJBGQGQKFFLVDBJB GQ<mark>GQ</mark>KFFLVDBJG<mark>BGQQ</mark>KFFLVDBJBGQ<mark>GQ</mark>KFFLVBDGJ<mark>BGQQ</mark>FKFLVBGDJ<mark>BGQQ</mark>FKFLVBGJBD<mark>GQQ</mark>FFKLVGBJ<mark>GB</mark>DQ<mark>QFF</mark>LKVGB<mark>G</mark>JBDQ QFLKVGBGJBQDFQFLKVGGBJBQDFQFLKVGGBJBFQDFQLKVGGBJBFQFDQLKVBBJQDQGGKFFLDVBBJQQGGKFFLBVDJBQQGGKFF VBJD<mark>BQQ</mark>GGKFFLVBJDBQQGGKFFLBJVBDQQGGKFFLVBJBDQQGGFKFLVBJBQDGQGFKFLBVJBQDGQGFFKLVBJBQGDQGFFKLVBJ SQDFFKLVBJBGQGQDQQFFQLKVQBJBGQGDFFLKVBJGBGQDFFLKVBGJBGQDFFLVKBGBJGQFDFLVKBGBJGQFFDLVBKBJQDGF GVFKBJBQDGLFGFVKBBJQDGLFGFVKBBJQDGFLFGVBKBJQDGFLGFVBBJKQGFLGFDVBBJKQGFLGFDVBBJQKGFGLFDVBBJQKGFG LFDVBJBQKGFGLFVDBBJQKGFGFLVBDBQJGKFGFLVBDJQBGFGKFLVBDJBQGGFKFLVBDBJQGGFFLKVBBJQDGFGFLKVBQJBDKG L<mark>GF</mark>VBQJBDGFKL<mark>GF</mark>VBQJBDGFLK<mark>GF</mark>VBQJBDGFL<mark>GF</mark>KVBJQBDGFL<mark>GF</mark>KVBJQBDGF<mark>GLF</mark>VKBJQBGFD<mark>GF</mark>LVKBJQBGF<mark>G</mark>DFLVKBJQBGF^G FLDVKQBJBGFGFLDVKQJBGBFGFLDVKBQJGBFGFDOWN 9(8)GBFDOWN 9(7)GBFLDVKGQFJGBFBDOWN 10(8)FGBLDVKQBJG F<mark>GF</mark>LDVKQJBBDG<mark>GFF</mark>LKVQJDBBGF<mark>GLF</mark>KVQJBDBGF<mark>GLF</mark>KVQJBDB<mark>GGFLF</mark>KVQJBDG<mark>BFGF</mark>LKVQJBGD<mark>BGFF</mark>LKVQJBG<mark>BDGFF</mark>LVKQGJ^E GFBDFLKVQGJBGFBDFLVKQGJGBFBFLDVKGQGJFBFBDLVKGQGJFBFBLDVKGQGJFBFBLDVKGGGGFJFBLBDVKGG OFJFBL GBFBFDKVQGJGBDFBSFKVGQGJDFBSFBKVGQJGFDBFBKSVGQGJFDBFBKSVGGQJFDFBBKSVGGQJFBFDBKVGSGQJFFBDBKVGGQ^S BBDKVGGQFJFSBBKVGGQFJFSBBDKVGGQFJFBSBDKGVGFQJFBBSKDGVGFQJFBBKSDGVGFQJFBBKGSVGFFQJDBBKGGVFQF^J SBBDKVGGQJFBFBKSDVGGQJKFBFBSDVGJQGKFBFBDSGVQJGKFFBBGDVQGJSFKFBBGGVJDQFKSFBBGGVQDJFFKSBBGGVJQDF KBBSGGQVJFDFKBBSGGVQFJFDKBBSGGVFJQFDKBBGSGFVQJFDKBBGGSFVJQFDKBBGGFFVSQJDKBBGGFFVQJSDKBBGGFFQV^J ĸġĔġġveĸĔĔġġġŗŗĸġvjeġġġĸŗġŗġvjġĔġġŗĸŗġġvjġĔġĔĔĸŗġġvjġġĔĔĔŔġġvġġĔĔĔŔġġvġġĔſĔĔĔĸġġvġġĔŔ BFBDKQVJGGSFFBBDKQVJGGSFFBBDKQVGJGFFSBBKDQGVGJFFBSBKDQGVGJFFBBKSDGQGVJFFBBKDSGQGVJFFBBKDGSGQVJF FBBKDGGQVSJFFBBKGDGQVJSFFBBKGGDQVJFFSBBGKGDVQFJFSBBGGKQVDFJFSBGBGKQVFDFJBGSBGKVQFFDJGBBSKQVFFDJ GBBDOWN 13(8) BDOWN 9(9) BDOWN 9(9) BDOWN 9(8) BDOWN 9(9) BDOWN 9(10) BDOWN 9(10) BDOWN 9(9) BDOWN 9(9) BDOWN 9(9) BDOWN 10(10) BDOWN 9(9) BDOWN 10(9) BDOWN 9(8) BDOWN 9(8) BDOWN 9(9) BQJKFGVD

