Problem 2—Cryptograms

Many people presume that zombies are less intelligent than regular people because they speak in an indecipherable pattern of grunts and groans. Actually, that only goes to show how intelligent zombies are because English, in particular, is readily decipherable. A number of newspapers regularly print cryptograms, a paragraph in which each of the twenty-six letters has been replaced by its counterpart under some preselected permutation of these twenty-six letters.

In fact, cryptograms are not particularly difficult to solve, and cryptographers scoff at their simplicity. First observe that E is, by far, the most common letter in the English language, so the letter that appears most frequently in the cryptogram is highly likely to represent E. Along these lines, the most common word in the English language is THE, so that the most common pattern of three distinct letters (counting both three-letter words and three-letter substrings of longer words) ending in E is almost certainly going to be THE, thus revealing which letters stand for T and H. There are other clues, too, to locate letters such as A and R, but it turns out that most of the time, these aren't even necessary. Locating E, H, and T usually fills in enough letters so that *Wheel of Fortune* can be played on the rest of the cryptogram. This is a remarkably simple strategy, and it almost always works unless the encrypted passage is very short or is constructed specifically and consciously to violate these rules.

Given a piece of encrypted text, you are to locate the letters E, H, and T present in the passage. The test cases will be solvable by the rules given above. There will be no dirty tricks.

INPUT SPECIFICATION. Each input case will consist of a number of lines of text, each followed by **<EOLN>**, with an extra **<EOLN>** following the data case. These lines should be concatenated together in input order with a space separating adjacent lines. The resulting string is the encrypted text. It will contain only uppercase letters, spaces, and punctuation. In particular, digits and lowercase letters will not appear in the string. The last input case will be followed by **<EOF>**.

OUTPUT SPECIFICATION. The output cases should appear in the same order as the input cases. Each output case will be of the form "Case *c*: *T*" (where *c* is the number of the input case and *T* is the partially decrypted text. *T* should not be broken up into smaller lines; it should be one long line. The appropriate letters should be replaced by E, H, and T, and all other letters should be replaced by underscores. All other characters (punctuation and spaces) should be unchanged. Each output case should be terminated by two **<EOLN>**'s.

SAMPLE INPUT.
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IPY·QDLH·RFPRTF,·GOF·VFFWFLB·EFIPYF·CG.·RDGYZJW'C·BDH·ZC·D·GZQF·PI<EOLN>
JFTFEYDGZPL·DLB·ZLFEYZDGZPL,·ENG·IPY·GOF·YFCZBFLGC·PI·ODTSFYCPL·ODTT,·ZG<EOLN>
VDC·DL·PRRPYGNLZGH·GP·BP·CPQF·INLBYDZCZLX·IPY·D·VPYGO·JDNCF.<EOLN>
DRRYPAZQDGFTH·IZIGH·CGNBFLGC·XDGOFYFB·ZL·GOF·RDHLF-ODTSFYCPL·TPEEH·PL<EOLN>
CDGNYBDH,·QDYJO·IPNYGFFLGO·DG·GFL·R.Q.·GP·RDYGZJZRDGF·ZL·D·GVFTSF-OPNY<EOLN>
GOZLX-D-GOPL.··KDQFC·BHFY,·D·IYFCOQDL·RPTZGZJDT·CJZFLJF·QDKPY,·CDZB·D<EOLN>
GOZLX-D-GOPL·ZC·DL·FSFLG·ZL·VOZJO·RFPRTF·YFJFZSF·CRPLCPYCOZRC·PY<EOLN>
BPLDGZPLC·GP·BP·CPQFGOZLX·GOFH·FLKPH·ZL·D·RNETZJ·RTDJF·IPY·D·CRFJZIZFB<EOLN>
DQPNLG·PI·GZQF.·GOF·FSFLG·VDC·RNG·PL·EH·GOF·ODTSFYCPL·ODTT·OPNCF<EOLN>
XPSFYLQFLG·GP·YDZCF·QPLFH·DLB·GP·DBSFYGZCF·LQN'C·YFTDH·IPY·TZIF,·D<EOLN>
GVFLGH-IPNY·OPNY·VDTW-D-·GOPL,·VOZJO·VZTT·GDWF·RTDJF·PL·QDYJO<EOLN>
GVFLGH-CFSFLGO·DLB·GVFLGH-FZXOGO.·GOF·YFTDH·ZC·CZQZTDY·GP·PGOFYC·DTT·DJYPCC·GOF<EOLN>
JPNLGYH·GODG·DGGFQRG·GP·YDZCF·DVDYFLFCC·DLB·INLBZLX·IPY·JDLJFY·YFCFDYJO.<EOLN>
<EOLN>
AHG·XQFJ·OE·BK·EHGWHGFJ,·O·EHPXX·VQA·NPVA.··HG·BPSGAH·BG·AQ·XOG·JQNV·OV<EOLN>
IFGGV·WPEALFGE.··HG·XGPJGAH·BG·TGEOJG·AHG·EAOXX·NPAGFE.··HG·FGEAQFGAH·BK<EOLN>
EQLX.··KGP,·AHQLIH·O·NPXS·OV·AHG·MPXXGK·QZ·AHG·EHPJQN·QZ·JGPAH,·O·NOXX<EOLN>
ZGPF·VQ·GMOX·ZQF·AHQL·PFA·NOAH·BG.··AHK·FQJ·PVJ·AHK·EAPZZ,·AHGK·CQBZQFA<EOLN>
BG.··AHQL·WFGWPFGEA·P·APTXG·TGZQFG·BG·OV·AHG·WFGEGVCG·QZ·BOVG·GVGBOGE.<EOLN>
AHQL·PVQOVAGEA·BK·HGPJ·NOAH·QOX;·BK·CLW·FLVVGAH·QMGF.··ELFGXK·IQQJVGEE<EOLN>
PVJ·BGFCK·NOXX·ZQXXQN·BG·PXX·AHG·JPKE·QZ·BK·XOZG·PVJ·O·EHPXX·JNGXX·OV<EOLN>
AHG·HQLEG·QZ·AHG·XQFJ·ZQFGMGF.··PBGV.<EOLN>
<EOLN>
<EOF>
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SAMPLE OUTPUT.
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Case·1:··____·_____·_E___E,·THE·_EE_E__·_E___E·_T.·__T_____'_·____·__·_·T__E·__·_E_E___T__
_·___·__E____T____,·__T·____·THE·_E___E_T_·__·H___E_____·H___,·_·_T·___·__·_____T___T__T_·_
_·___E·_____·____·_·___TH·_____E.·_____TE__·____T_·_T__E_T_·__THE_E_·__·THE·____
_E-
H___E_____·_____·__·__T_____,·_____H·____TEE_TH·_T·TE_·_._._·_T_·___T_____TE·__·__T_E__E-
H___·TH___-_-TH__···___E_·__E_,·_·__E_H____·____T_____·___E__E·_____,·_____·_·_TH___-_-
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TH__·__·__·E_E_T·__·_H__H·_E___E·_E_E__E·_____H___·__·____T____·T_·__·___ETH___·THE
_·E____·__·_·_____·___E·___·_·__E____E_·____T·__·T__E.·THE·E_E_T·___·__T·__·__·THE·
H___E____·H___·H__E·___E___E_T·T_·____E·___E_·____·T_·___E_T__E·___'_·_E___·___·___E,·
_·T_E_T_-____·H___·____-_-·TH__,·_H__H·____·T__E·____E·__·____H·T_E_T_-
_E_E_TH·____·T_E_T_-
E__HTH.·THE·_E___·__·_____·T_·_THE__·___·_____·THE·____T__·TH_T·_TTE__T·T·____E·__
__E_E__·___·_____·___·____E_·_E_E___H.<EOLN>
<EOLN>
Case·2:··THE·____·__·__·_HE_HE__,·_·_H___·__T·___T.··HE·___ETH·_E·T_·__E·____·__·__EE_
·___T__E_.··HE·_E__ETH·_E·_E___E·THE·_T___·__TE__.··HE·_E_T__ETH·__·____·.·_E_,·TH___H
·_·____·__·THE·____E_·__·THE·_H____·__·_E_TH,·_·____·_E___·__·E___·___·TH__·__T·__TH·_E
.··TH_·___·___·TH_·_T___,·THE·_____T·_E.··TH__·__E___E_T·_·T___E·_E___E·_E·__·THE·__
E_E__E·__·___E_E_E__.·TH__·_____TE_T·__·HE__·__TH·___;·_·__·___·____ETH·__E_···___E__·
_____E_·_·___·_E___·____·_____·_E·____·THE·____·__·__·___E·___·_·_H___·_E__·___·THE·H__
_E·__·THE·____·___E_E_.··__E_.<EOLN>
<EOLN>
<EOF>
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