

## FY]hYb ]b A cbhYj YfXYž 7cghU F ]WU

FY]hYb']b'AcbhYj YfXY'j YfUb`Uggh'?]Užni '< Ui gY']b; fc» Vf]hUbb]Yb'Y]b][Y'8]b[Y'ni 'ØVYfXYb\_Yb'=\W'k Uf g\_Ydh]gW\žk Ug'FY]hYb']b'AcbhYj YfXY'Ub[Y\h''A]f'k i fXY [YgU[hžXUgg'k]f'\_Y]bY'<Y`aY'VY\_caaYb'k ØfXYb'i bX'XUgg X]Y'Ofh`]W\Yb': Ø\fYf'\_Y]b'9b[`]gW\gdfYW\Yb'\_ObbhYb''A]h `YhnhYfYa'\_cbbhY']W\ia[Y\Ybž'UVYf'YfghYfYg'k Uf'Y]b DfcV`Ya''=\W\\UVY'a]f']b'XYf'JYf[Ub[Yb\Y]h'n]Ya`]W\'j]Y`GW\UXYb'ni [YZØ[hž]bXYa']W\'\_Y]bYb'<Y`a'[YhfU[Yb'\UVY'' BUW\XYa']W\'&\$\%+'jca'DZYfX'[YZU``Yb'V]bž\UVY']W\'a]f'jcf[YbcaaYbž'b]Y'c\bY'ni 'fY]hYb''HfchnXYa'k c``hY']W\'ibVYX]b[h']b'7cghU'F]WU'fY]hYb'[Y\Ybž'U`gc'[]b[']W\'ni 'XYbGh\'Dyz'ia'Yga']f'gY`Vgh'Ubni gY\Yb''/Uad^\Y``]d/

 $FY]hYb^{\circ}]b^{\circ}A^{\circ}cbhYj^{\circ}YfXY^{\circ}j^{\circ}YfUb^{\circ}Uggh^{\circ}?^{\circ}]U\check{z}^{\circ}ni^{\circ}< Ui^{\circ}gY^{\circ}]b^{\circ};^{\circ}fc^{\ast}Vf]hUbb^{\circ}Yb^{\circ}Y^{\circ}b^{\circ}[Y^{\circ}ni^{\circ}@VYfXYb_Yb^{\circ}]$ 

→W. 'k Uf'g\_Ydh]gWX ž'k Ug'FY]hYb']b'A cbhYj YfXY'Ub[Y\h"'A]f'k i fXY
[YgU[hž'XUgg'k]f'\_Y]bY'<Y`a Y'VY\_ca a Yb'k ØfXYb'i bX'XUgg'X]Y
Òfh`]WXYb': Ø\fYf'\_Y]b'9b[`]gWX'gdfYWXYb'\_ÒbbhYb"'A]h'`YhnhYfYa
\_cbbhY']WX i a [Y\Ybž'UVYf'YfghYfYg'k Uf'Y]b'DfcV`Ya"</pre>

⇒W `\UVY`a ]f`]b`XYf`JYf[Ub[Yb\Y]h`n]Ya `]WX`j ]Y``GWXUXYb
ni [YZØ[hž']bXYa `]WX`\_Y]bYb`<Y`a `[YhfU[Yb`\UVY"BUWXXYa `]WX
&\$%+'j ca `DZYfX`[YZU``Yb`V]bž`\UVY`]WX`a ]f'j cf[Ybca a Ybž'b]Y
c\bY`ni `fY]hYb"'HfchnXYa `k c``hY`]WX`i bVYX]b[h`]b`7cghU`F]WU
fY]hYb`[Y\Ybž'U`gc`[]b[`]WX`ni `XYb`GhÀ``Ybž'i a `Yg'a ]f'gY`Vgh
Ubni gY\Yb"
</pre>

K ]Y'g]W\'\YfUi gghY``hYž'k Uf'XUg'Òfh`]W\Y'I bhYfbY\a Yb'[fØbX`]W\
Ui g[YghUhhYh'i bX'i bgYf'; i ]XY'gdfUW\'Ui g[YnY]W\bYhYg'9b[`]gW\"
HUhgÀW\`]W\'k Uf'XYf'GYfj ]WY'gc'dfcZYgg]cbY``ž'XUgg'k ]fž'U`g'nk Y]

A ]h[`]YXYf'i bgYfYf'6i W\i b[ 'ni 'gdÀh'\_Ua Ybž'Ui Z[ YZcfXYfh k i fXYbž'c\bY'g]Y'ni '[ Y\Yb"'G]Y'k ØfXYb'Y]bYa 'UbXYfYb': Ø\fYf ni [ YhY]`h"

"U`h1 25h`Ug'/ "6cchg"FY]hYb"]b"AcbhYjYfXY

DY hY f'i b X'] WX 'a UWX hY b'i b g'Ui Z'XY b'K Y [ž'VY [`Y] hY h'j c b'nk Y] Ub XY fY b'; ÀghY b'i b gY fY f'B Uh] c b U`'; Y c [fUd \] W9 I d Y X] h] c b'b UWX 7 c ghU'F] WU'i b X'i b gY fY a '`c\_U`Y b': Ø \fY f''

9g'k Uf'VYfi \][YbXž'XUgg'U``Y'j]Yf': U\fYf'i b[YZÀ\f'X]Y'[`Y]W\Yb
: À\][\_Y]hYb'\UhhYb"'=\X'k Uf'Ui Z'9l\_i fg]cbYbž'k c']W\'a ]h'5VghUbX
XYf'ghÀf\_ghY': U\fYf'i bX'i a [Y\_Y\fh'XYf'gW\k ÀW\ghY'k Uf"'=\b
A cbhYj YfXY'k UfYb'k]f'U``Y'gW\cb'Y]ba U``[Yf]hhYb'i bX'ZØ\`hYb
i bg'k c\``a ]h'DZYfXYbž'UVYf'b]Ya UbX'ZØ\`hY'g]W\'ØVYfhfcZZYb"'9g
[UV'Y]bYb'Ub[YbY\a Yb'Hcb'ZØf'i bgYfY'nk Y]ghØbX][Y': U\fh'Ub"

8 Ugʻnk Y]hYž'k Ugʻa ]fʻUi ZZ]Yʻž'k UfʻX]YʻgWk ]YfYʻJ ]YʻZUʻhʻXYf @UbXgWk UZhʻʻB UWkʻa Y]bYfʻʻYhnhYbʻ: U\fhʻfKi fWkʻX]Yʻa cbXÀ\bʻ]WkY @UbXgWk UZhʻj cbʻGk U\_cdʻ]bʻB Ua ]V]UŁʻk UfʻYgʻYfZf]gWkYbXžʻXi fWkʻgc j ]Yʻʻ; fØbʻni ʻZU\fYb.ʻgUa h][Yʻ< $\emptyset$ [Y`ʻa ]hʻk Y]hYbʻ5i gV`]W\_YbžʻX]Wk hY K À`XYfž'X]Yʻg]Wkʻj cfʻ@YVYbʻfY[Ybžʻi bXʻcZZYbYž qcbbYb[YqdfYb\_Y`hYʻ9VYbYb''

HY]`k Y]gY`Xi fZhYb`k ]f`hfUVYb"`A Y]b`DZYfXž`A U`]Vi ž`VfUW\`gc[Uf`]b Y]bYb`; U`cdd`Ui g"`9g`Yf]bbYfhY`a ]W\`XUfUbž`k Ufi a `]W\`XUg : U\fYb``]YVY` `X]Y`@UbXgW\UZhž`XYb`BYfj Yb\_]hnY``i bX`X]Y`: fY]\Y]h Ui Z`cZZYbYf`GhfU»Y` `UVYf`Ui W\`XUfUbž`k ]Y`j ]Y``]W\`bcW\``YfbYb a i gg"

GY`Vghj YfhfUi Ybž'HYW\b]\_'i bX'9h]\_YhhY'gd]Y`Yb'VY]'Y]bYf nk Y]ghØbX][Yb': U\fh'\_Y]bY'[fc»Y'Fc``Yž'g]bX'UVYf'ZØf'a Y\fhÀ[][Y 5i gZØ[Yž'k]Y']W\'g]Y'Ui gdfcV]YfYb'a ÒW\hYž'i bYf`Àgg`]W\"

➡nk ]gWXYb '\ UVY ']WX 'a ]WX ']b 'a Y]bYb 'GUhhY` [ YgYhnh' 'K ]f
gWX`Àb[ Y`hYb 'i bg'Xi fWX 'K À`XYfžYbhXYW\_hYb'J Ò[ Y` 'i bX
B UgYbVÀfYb 'i bX 'hUi WXhYb'Ui Z'Y]bYf'K ]YgY'Ui Z'' '9]b 'F Y[ YbVc[ Yb
Yf\cV 'g]WX 'ZUgh'gcž'U`g'k ÀfY 'Yf'Xcfh' [ YdZ'Ubnh'k cfXYb" 'B UhØf`]WX

a UW hYb k ]f Y ]b Y : chcdUi gY "

'U'h1 25h'Ug/ '6cchg' f [YbXkc'i bhYf'XYa 'FY[YbVc[Yb

9]bY'hfà[Y'8àa a Yfi b['hf]YV'bà\Yfž'U`g'k]f'Ub': Y`XYfb'a]h
Y`Y[UbhYb'6ài a Yb'j cfVY]Zi \fYbž'XYfYb'G]`\ci YhhYb'g]W\'[Y[Yb
Y]bYb'`cXYfbXYb'<]a a Y`'dfYgghYb"'K]f'gW\`àb[Y`hYb'i bg'ØVYf
Dcgh\_UfhYb\Ø[Y`'i bX'\]Y`hYb'XUbb'Ubž'i a 'XYb'GcbbYbi bhYf[Ub[
ni 'VYcVUW\hYbž'i bgYfY'DZYfXY'gW\]YbYb'[YbUi gc'j Yfh]YZh'ni 'gY]b
k]Y'k]f"

5`g`g]WX`i bgYf`FY]hbUWXa ]hhU[`]b`A cbhYj YfXY`XYa `9bXY
ni bY][hYž'k i gghY`]WXž'XUgg`Y]b`GUa Yb\_cfb`[YgÀh`k cfXYb`k Uf"`\#WX
Yf]bbYfhY`a ]WX`XUfUbž'k ]Y`gY\f`]WX`XUg`FY]hYb``YfbYb`k c``hY.
gY`VghVYk i ggh`[U`cdd]YfYbž'ZØgg][Yf`i bX`\_cbhfc``]YfhYf`gY]bž
DfcV`Ya Y`Yf\_YbbYb`i bX`gWXbY```VY\YVYb`i bX`gWX`]Y»`]WX`U``Y]bY
fY]hYb"

- 'U`h1 2

F]Wkh][Yg'FY]hYb'ni '`YfbYb'k Uf'gWkcb'`Ub[Y'Y]b'N]Y`'j cb'a ]fž
UVYf']Wk'\UVY'Yg'Ui Z[YgWkcVYbž'i a 'Ui Z'a Y\f'NY]h'i bX'; Y`X'ni
k UfhYb"'8]YgY'FY[U`Y'k i fXYb'Xi fWk'i bgYfY'\Ài Z][Yb'FY]gYb
Yhk Ug'ØVYfXYW\_h"'8]Y'gWk]YfY'5\_h]j ]hÀh'Ui Z'XYf'GhfU»Y'j YfV]f[h
X]Y'HUhgUWkYž'XUgg']Wk'ni '<Ui gY'bi f'k Yb][Y'À\b`]WkY

 $\label{eq:continuous} $\operatorname{Jcf}(X) = (-1)^{-1} \operatorname{dist}(X) + (-1)^{-1$ 

'a Y]bY'YfghYb'gY]h'&\$\%z'U\g']W\'ni a 'YfghYb'A U\']b'@cbXcb FY]hYb'\YfbhY''K ]Y'XUg'Gdf]W\k cfh'gU[hz'k]Y'k]f'i bgYfY'HU[Y j YfVf]b[Ybz'j YfVf]b[Yb'k]f'bUhØf']W\'i bgYf'@YVYbz'i bX']W\ a ÒW\hY'a Y]b'@YVYb'b]W\h'a ]h'K UfhYb'j YfVf]b[Yb''

 $8 \ Ug']gh'_Y]bY'gWX`YWXhY'@Y_h]cb'ZØf'nkY]'Ghi bXYb'FY]hYb"$ 

## FY]hYb ]b A cbhYj YfXY. XUg K YgYbh`]WXY

K c. 'K ]f'ØVYfbUW\hYhYb']b'Y]bYf'FY]\Y'j cb'A ]hhY`\_`UggY\chY`gž j cb'XYb'Ødd][Yb'5b`U[Yb'i bX'\_ca ZcfhUV`Yb'N]a a Yfb']a '5fYbU` A UbcU']b'@U': cfhi bU'V]g'\]b'ni 'Y]bZUW\YfYb'I bhYf\_ØbZhYb']a 6Yf[\ØhhYbgh]`']a '<chY`'<Y`]Wcb]U']b'A cbhYj YfXY'i bX'gc[Uf GW\]ZZgWcbhU]bYfbž'X]Y'U`g'N]a a Yf']a '9`': Ufc'i a Z b\_h]cb]Yfh k i fXYb'VY]'A Ubi Y`'5bhcb]c"

K Ubb. '8]Y 'VYghY 'FY]gYnY]h' ZØf'7cghU'F]WU']gh'X]Y 'HfcW\_YbnY]h'j cb 8YnYa VYf'V]g'5df]' "'J]Y 'GcbbYbgWXY]b'a UWXh'Yg'ni 'Y]bYf']XYU'Yb NY]hži a 'gck c\''X]Y '6Ui a \_fcbYb'U`g'Ui WX'X]Y'? ØghY'ni Yf\_i bXYb"'8]Yg']gh'YXcWX' < cWXgU]gcbž'U`gc'Yfk UfhYb'G]Y'a Y\f Hci f]ghYb'i bX'\Ò\YfY'DfY]gY"'8]Y BYVYbgU]gcb'j cb'A U]'V]g'\$\f \]i bX'Bcj Ya VYf']gh'YVYbZU``g'Y]bY'[i hY'NY]h'ZØf'Y]bYb'6Ygi WX"'9g fY[bYh'a Y\fž'UVYf'Yg']gh'fi \][Yf'i bX'X]Y'K À`XYf'7cghU'F]WUg ghfchnYb'j cf'@Ui V"

 $\begin{array}{l} K \ ]Y. \ FY]hYb \ ]b \ A \ cbhYj \ YfXY \ \_Ubb \ VY] \ 7 \ UVU \ Yf]nU \ 9 \ Fc \ XYc \\ [YVi \ Wh \ h'k \ YfXYb. \ Z \ ) \ $* \ '&* \ (\ ) \ ') \ +* \ (\ '\#Z \ ) \ $* \ '&* \ (\ ) \ '* \ ' \ $* \ /'(\ ) \ 'I \ G8 \\ dfc \ DYfgcb \ ZØf \ Y]b \ Y \ nk \ Y]ghØb \ X][Y \ : \ U\ fh'' \\ \end{array}$ 

K ]f`\UVYb`i bgYfY`: U\fh`Ui Z`i bgYfYf`-!hÀ[][Yb`BUh]cbU`; Yc[fUd\]W9I dYX]h]cb`bUW\'7cghU`F]WU'ØVYf`XYb`7\]YZ 9I dYf]YbW'CZZ]WYf`f79C $\pm$ '[YVi W\h"

: fØ\ghØW\_YžY]b][Y'A U\`nY]hYb'i bX'nU\`fY]W\Y'5\_h]j ]hÀhYbž
XUfi bhYf'Y]bYb'[YZØ\fhYb'BUhi fgdUn]Yf[Ub[']a 'GUbhU'9`YbU
7`ci X': cfYgh'FYgYfj Yž'VY]'XYa 'g]Y'`Yfbhž'Hcfh]``Ug'j cb'8cl U'A UfU
]b']\fYf': Ua ]`]Y'\Yfni ghY``Yb'bUW\'<Ui gY'i bX'Y]bY'Hci f'Xi fW\'X]Y
? UZZYY\_ccdYfUh]j Y'A ]'7UZYW]hc"

8]Y 'Hci f'k ]fX 'U`g` BUh]cbU`; Yc[fUd\]W \(\infty\) ifbYm 'Y]b[Yghi Zhz'X]Y ]b 'DUfhbYfgW\\UZh'a ]h'; '5Xj Ybhi fYg'Xi fW\\[YZØ\fh'k ]fX" @ I i f]\hat{O}gYfY'Cdh]cbYb'g]bX'i bhYf'XYb'6UbbYfb'@ I i fm'9Wc @cX[Ygz'Df]j UhY'\text{h'9I dYX]h]cbgz'9I dYX]h]cb 7fi ]gYgz'F]j Yf'7fi ]gYg'i bX'Hci fg'K ]h\\ '5b'9I dYfh'j YfZØ[VUf"

: Øf'k Y]hYfY' +b Zcfa Uh]cbYb'cXYf'6i Wkib[Yb'fi ZYb'G]Y'\$, \$\$'((\$ &)) %'Ub'cXYf'Vi WkYb'G]Y'cb`]bY"

 $K ]f'g]bX'a ]h'6f]h]g\'5]fk Umg'bUW '7cghU'F]WU'[YZc[Yb''6iWXYbG]Y': `\emptyset[Y'ni'XYb'VYghYb'DfY]gYb'ØVYf'G_mgWUbbYf''$ 

'U`h1 2

CZZYb`Y[ib[.'K]f'g]bX'a]h'IbhYfghØhnib['jcb'BUh]cbU`; Yc[fUd\]W9IdYX]h]cbg'bUWX'7cghU'F]WU'[YfY]gh''5``YDiV`]\_Uh]cbYb'gU[Yb'XUgž'UVYf'k]f'[UfUbh]YfYb'k]f\_`]WX'\_Y]bYdcg]h]jY'6Yf]WXhYfghUhhib[''K]f'gU[Ybž'kUg'k]f'XYb\_Yb''[ihibXgWX`YWXh''XUa]h'G]Y'a]h'Y\f`]WXYf'6YfUhib['ZibX]YfhY9bhgWXY]Xib[Yb'hfYZZYb'\_ObbYb'''

8 Y hU1`a

6 Ygi WX Yb 'G]Y 'i bg 'Ui Z 'Y]bY!fY]gY "XY