

ARTS3290

J g = Y [Yg cZ i i fY]

7ci fgY⁻Cj Yfj]Yk

GHJZ7cbHJWh8YHJ]`g

7cbj Ybcfg

B Ua Y	9a U]`	5j U]`UV]`] m	@cWUh]cb	D\cbY
GU`]\U'6Y`a Yggci g	g"VY`a Yggci g4 i bgk "YXi "Ui	K \]`Y`k Y`UfY	A 6' \$'	-',)&'*&
		k cf_]b[ˈfYa chY`mž		
		d`YUgY'Ya U]`'a Y'hc		
		UffUb[Y'U		
		d∖cbY#]XYc		
		Wcbgi `Uh]cb		

GWXcc`7cbHJWhi±bZcfa Uh]cb

GWkcc``cZ<iaUb]h]Yg'UbX'@Ub[iU[Yg

@c\\U||cb. G\\cc``C\\Z|\\\žA\cfj\Yb'6fck\b'6i]\X]b[\z'@\j\Y``&z'&),

CdYb]b['<ci fg. 'A cbXUm!': f]XUmž'- Ua '!') da

D\cbY.'Ž*%'&'-',)'%*,%

: UI . Ž*%'&'-',) ', +\$)

9a U]`. \<u>U`4 i bgk "YXi "Ui</u>

7ci fgY 8YW] g

7 fYX]hDc]bhg * *

Gi a a UfmcZh\Y 7ci fgY

 $\label{thm:condition} $$H\Y'gh XmcZYa\ d]fY']g'Wf]hWU'']b'i\ bXYfghUbX]b['h\Y'dcghWc'cb]U''dfYgYbhz'h\Y'fY!Ya\ Yf[YbW''cZYa\ d]fYz dYfg]gh]b['dfcV'Ya\ g'cZ+bX][Ybci\ g'f][\hg'UbX'hc'WcbhYa\ dcfUfmi bXYfghUbX]b[g'cZ\i a\ Ub'f][\hg'a\ cfY[YbYfU''m''+h\]g'Wci\ fgY'k]'''dfcj]XY'U'Wf]hWU''YI Ua]bUh]cb'cZ9i fcdYUb'Wc'cb]U'']XYc'c[]Yg'UbX'dfUWhWyg''+h k]'''U'gc'ZcW'g'cb'h\Y']a\ dYf]U''YI dYf]YbW'g'cZWc'cb]nYX'dYcd'Ygz''cc_]b['Uhk Umg']b'k \]W''h\YmYb[U[YXk]h\Ya\d]fY'UWfcqq'd'UWYg'UbX'ha\Y''$

9a d]fYg`]b`K cfX`<]ghcfmk]``cZYf`mci 'h\Y`cddcfh b]lmhc'i bXYfghUbX`k \Uh`]a dYf]U`]ga 'k Ug`UVci hž\ck `]h W\Ub[YX`h\Y`ZUW`cZh\Y`k cfX`UbX`]rg`]a dUWhcb`h\Y`dfYgYbh'`H\Y`Wci fgY`k]```ZJa]`]Uf]nY`mci 'k]h\`_Ym WcbW\drgž`hYI hg`UbX`a Yh\cXc`c[]Yg`Zcf`h\Y`ghi XmcZWca dUfUh]j Y`]a dYf]U`]ga 'Ug`k Y```Ug`YUf`m!a cXYfb`UbX a cXYfb`\]ghcfm'`H\cgY`k \c'gi WWggZ\``mWca d`YhY`h\]g`Wci fgY`k]```ghfYb[h\Yb`h\Y]f`UbU`mh]WU``UbX fYgYUfW\`g_]``g`Ug`k Y```Ug`h\Y]f`\]ghcf]WU``_bck `YX[Y"

7 ci fqY @YUfb]b['Ci hMca Yq

%" 5bU`mgY`_YmYj Ybhgž`]XYUgž'dYcd`Y`UbX`hfYbXg`]b`]a dYf]U``\]ghcfm

&" F YUX``cb[!hYfa 'dUhhYfbq']b'Wc`cb]U`]ga 'UbX`]a dYf]U``\]ghcfm'UbX'i bXYfghUbX'h\Y]f'q][b]ZwUbW

' " 9b[U[Y k]h\ Wf]h]WU`XYVUhYq cb]a dYf]U`]qa "UbX]hq `Y[UW]Yq

("5bU'mgY'UbX']bhYfdfYhXcWa Ybhq

) " 7 cbXi Wh]bXYdYbXYbhqWkc`Uf`mYbei]fm

HYUWX]b['GhfUhY[]Yq'

H\Y`WcifgY`]g`XYg][bYX`hc`YbWcifU[Y`mci`hc`Yb[U[Y`Wf]h]WU``mk]h\`dUghiUbX`W\ffYbhXYVUhYg`UVcih
9ifcdYUb`]a dYf]U`]ga`UbX`]hg`]a dUWicb`Wc`cb]gYX`UbX`Wc`cb]g]b[`gcW]Yh]Yg":\dik]```U`gc`]bhfcXi WY`mci`hc
fYWYbhfYgYUfW\`cb`\ia Ub`f][\hg`UbX`h\Y`f][\hg`cZ\dix][Ybcig`dYcd`Yg"`9UW\`k YY_`U`gdYW]Z]W]ggi Y`k]```VY
h\Y`ZcW g`cZh\Y`fYUX]b[gz`h\Y``YWfifY`UbX`h\Y`gYa]bUf`X]gW gg]cb"

H\Y`fYUX]b[gžU```VUgYX`cb`gW\c`Uf`m`]hYfUhi fYždfcj]XY`WcbhYI hi U``]bZcfa Uh]cb"`H\Y`cbY!\ci f``YWhi fYdfYgYbhg`9i fcdYUb`j]g]cbg`cZYa d]fY`VmYI d`cf]b[`h\Y`_Ym]XYUgž]XYc`c[]Yg`UbX`gmghYa g`h\Uhgi ddcfhYXYa d]fY!Vi]`X]b[`UbX`a UbU[Ya Ybh'`\\b'\\Y`&bX`UbX'' fX`\ci fgžkY`k]``ZcW g`cb`h\Y`jc]W\g`cZYa d]fY`Vmgh Xm]b[`XcW a Ybhg`dfcXi WYX`Vmh\cgY`k\c``]jYX`]b`h\cgY`Ya d]fYg`fWc`cb]gYX`dYcd`YgžcZZJ\J\]U`gžgYhhYfgŁ"KY`U]a`hc`i bXYfghUbX`\ck`]a dYf]U``gi VYW\g`YI dYf]YbWYX`Ya d]fYž]b`ch\Yf`k cfXgž\ck`h\YmYb[U[Y`k]h\

5ggYgga Ybh

5```UggYgga Ybhg'UfY'Wca di `gcfm'

EiYgh]cbg'hc'7cbg]XYf'Zcf'h\Y':]Y'Xkcf_'DfcYWh

 $\label{eq:continuous} \mbox{\ensuremath{\%}}\mbox{\ensuremath{\%}}\mbox{\ensuremath{\mbox{\ensuremath{\mbox{\m}\mbox{\mbox{\mbox{\mbox{\mbox{\m}\mbox{\mbox{\mbox{\mbox{\mbox{\mbox{\mbox{\mbox{\mbox{\mbox{\mbox{\mbox{\m}\mbox{\mbox{\m}\mbox{\mbox{\m}\m}\mbox{\mbox$

 $\& \verb| "`DfYgYbh'h Y` \]ghcf] \verb| WU ``WcbhYl |$

Mci 'Wub'i gY'h\Y'a UhYf]U`'dfcj]XYX']b'h\Y'Wti fgY'flYWfi fYg'UbX'hi hcf]U`'X]gW gg]cbgŁ"

: YYXVUW_j]U']bX]j]Xi U`Wca a Ybhg"

 $\label{thm:continuous} \begin{tabular}{ll} Hi fb]h]b"gYh]b[."H\]g"Ugg][ba Ybh]g"gi Va]hhYX"h\fci [\Thi fb]h]b"UbX"ghi XYbhg"WUb"gYY"Hi fb]h]b"g]a]"Uf]hm fYdcflg" \\ \begin{tabular}{ll} Hi fb]h]b"gYh]b"[."H\]g"Ugg][ba Ybh]g"gi Va]hhYX"h\fci [\Thi fb]h]b"UbX"ghi XYbhg"WUb"gYY"Hi fb]h]b"g]a]"uf]hm fYdcflg" \\ \begin{tabular}{ll} Hi fb]h]b"g"ugg][ba Ybh]g"gi Va]hhYX"h\fci [\Thi fb]h]b"UbX"ghi XYbhg"WUb"gYY"Hi fb]h]b"g]a]"uf]hm fYdcflg" \\ \begin{tabular}{ll} Hi fb]h]b"g"ugg][ba Ybh]g"gi Va]hhYX"h\fci [\Thi fb]h]b"UbX"ghi XYbhg"WUb"gYY"Hi fb]h]b"g]a]"uf]hm fYdcflg" \\ \begin{tabular}{ll} Hi fb]h]b"guyuhan fydcflg" \\ \begin{tabular}{ll} Hi fb]h]b"g]a]"uf]hm fYdcflg" \\ \begin{tabular}{ll} Hi fb]h[h]b"g]a]"uf]hm fYdcflg" \\ \begin{tabular}{ll} Hi fb]h[h]b"g]a] fuguyuhan fydcflg" \\ \begin{tabular}{ll} Hi fuguyuhan fy$

5ggYgga Ybh' . '7`Ugg'hYgh

GhUfhXUhY. Bch5dd`]WUV`Y

@Yb[h\. %\$\$ a]bi hYg

8YHJ]`g.

±Đ! WUgg 'H'gh ``cb['Ubgk Yf'ei Ygh]cbg" 'Ghi XYbhg 'fYW']j Y 'U'bi a Yf] WU``a Uf_'UbX 'Wcbgi `hih\Y ``YWhi fYf'Zcf Z fh\Yf'ZYXVUW_"

5XX]h]cbU`XYhJ]`g.

 $H(Y^{-}]b! WUgg H(gh^{-})g' H(gh^{-})bY' H(gh^{-})h' Uhk]^{-}VY' Y^{-}X' Xi f]b[H(Y^{-})UhX' k]W' mci'k]^{-}qi Va]h'h(fci ['Hi fb]h|b"$

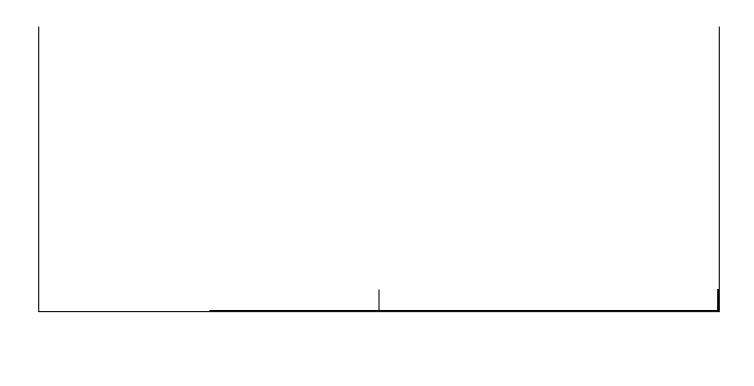
@Yb[h\.'%\$\$'a]bi hYg"

.

Hi fb]h]b'gYh]b[.'H\]g'Ugg][ba Ybh]g'gi Va]hhYX'h\fci [\'Hi fb]h]b'UbX'gh XYbhg'Xc'bchgYY'Hi fb]h]b g]a]'Uf]hmfYdcfhg"

5 hm/b XUbVW F Yei]fYa Ybhg

 $5\,\text{HY}\,\text{bXUbWY}\,\text{cZHi}\,\,\text{hcf]}\text{U}\text{`g}^{\text{.}}$



FYgci fW/g

DfYgWf]VYX F Ygci fWYg

K YY_`ma UbXUhcfmfYUX]b[g'UfY'Uj U]`UV`Y'cb'A ccX`Y"

FYWca a YbXYX FYgci fW/g

 $\label{eq:localized_constraints} $$ Mci_g\ci_X:Vi_m< YUhXYf'GlfYYhg!GU'hYf'UbX'HfYj_cf'F''; Ymž'7_b[dWeS`V_5a'a`[We[_fZW?aVWd_I_adV,3_9'aTS^BWdebWUf[hWfBYk_!Mcf_...CI_ZcfX'I_b]j_Yfg]lmiDfYggž'&$%*£":H\]g'Vcc__']g'Uj_U]'UV'Y'UhhXY'I_BGK_6cc_ghcfY"'H\YfY'UfY'U`gc'U'Wci_d'Y'cZWcd]Yg']b'hXY'<I_7'UhhXY'']VfUfm''I_bZcfhi_bUhY`mhXYfY']g'bc'Y! WcdmUj_U]`UV`Y'''$

='U'gc'fYWca a YbX'>UbY'6i fVUb_'UbX': fYXYf]W_'7 ccdYf \ddot{z} 7_ b[dWe [I adV : [efack, Bai WdS` V fZWBa'ff[Ue aX6 [XWdW UWfDf]bWhcb.'Df]bWhcb'I b]j Yfg]hmDfYgg \ddot{z} &\$\%\d'\dV \dV ? f]g\Ub'? i a Uf \ddot{z} 7_ b[dWe, 3 : [efac[US^S` V Ba'ff[US^E aU[a'aYk f7 Ua Vf]X[Y.'Dc`]hmDfYgg \ddot{z} &\$\%\d'

5XX]h]cbU`fYUX]b[g`cb`k YY_`mhcd]Wg`WUb`VY`Zci bX`cb`h\Y`A ccX`Y`Wci fgY`dU[Y"

7 ci fgY '9j U'i Uh]cb 'UbX '8 Yj Y`cda Ybh

Ghi XYbhZYXVUW_k]``VY`[Uh\YfYX`j]U`A m9I dYf]YbWY`Uhih\Y`YbX`cZh\Y`Wci fgY`UbX`h\fci [\`U`Vf]YZ]b!WUgg Yj U`i Uh]cb`Xi f]b[`h\Y`hf]a YghYf"

Gi Va]gg]cb cZ5ggYgga YbhHUg_g

Hi fb]h]b Gi Va]gg]cb

Image: Ybwei bhyfu'dfcv'ya k \yb'uhhya dhjb['hc'gi va]hmci f'Ugg][ba Ybhh\fci [\ 'Hi fb]h]bž'd'YUgY

Hy'Yd\cby'9| hy'fbu''Gi ddcfhcb'-',) '' ' ' %cf'Ya U]''h\Ya 'cb'Y! hy'fbu'hy'hgi ddcfh4 i bgk "YXi "Ui "''Gi ddcfh
\ci fg'UfY', .\$\$Ua '-'%\$.\$\$da 'cb'k YY_XUmg'UbX'-.\$\$Ua '-').\$\$da 'cb'k YY_YbXg'fl *) 'XUmg'U'mYUft"'=Z'mci
UfY'i bUV'Y'hc'gi va]hmci f'Ugg][ba YbhXi Y'hc'U'ZJi 'hk]h\ 'Hi fb]h]b'mci 'a Um'Udd'mZcf'Ub'Y! hy'bg]cbž'Vi hmci
a i ghfYhJ]b'mci f'h]W_Yhbi a VYf'Zfca '9! hy'fbU''Gi ddcfhfU'cb['k]h\ 'Ubmch\Yf'fy'Yj UbhXcW a Ybhgt'hc
]bWi XY'Ug'Yj]XYbW' 'hc'gi ddcfhmci f'Y! hy'bg]cb'Udd']WUh]cb"'=Zmci 'Ya U]''9! hy'fbU''Gi ddcfhmci 'k]'`
Ui hca Uh]WJ'`mfYW']j Y'U'h]W_Yhbi a VYfZ'Vi h]Zmci 'hY'Yd\cbY'mci 'k]``bYYX'hc'gdYW]Z]WJ'`mUg_'Zcf'cbY''
Hi fb]h]b'U'gc'dfcj]XYg'i dXUhy'g'cb'h\Y]f'gmghYa 'ghUh' g'cb'Hk]hyf''

; YbYfU`mž'UggYgga YbhiHug_g'a i ghVY'gi Va]hhYX'Y`YVWfcb]\WJ``mij]U'Y]h\Yf'Hi fb]h]b'cf'U'A ccX`Y Ugg][ba Ybh''=b']bgHJb\W'g'k \YfY'h\]g']g'bchdcgg]V`Yž']hk]```VY'gHJhYX'cb'mci f'\\circ i fgY'g'A ccX`Y'g]hY'k]h\U`hYfbUh]j Y'gi Va]gg]cb'XYHJ]`g"

cfi]bZcfa Uhjcbicbi\ckihcigi Va]hUgg][ba Ybhgicbi]bYij]UiA ccXiY.i\hdg.#gh XYbhi bgk "YXi "Ui #\ck! gi Va]hUgg][ba Ybha ccXiY

5 WUXYa]W<cbYghmUbX D`U[]Uf]ga

D`U[]Uf]ga i]gii g]b[ih\Yik cfXgicfi]XYUgicZch\YfgiUbXidfYgYbh]b[ih\Ya iUgimci fick b"i=hWJbihU_Yia Ubm Zcfa gžZfca iXYi]VYfUhYiWXYUh]b[ihciUWW]XYbhU`mWcdm]b[iZfca iUigci fWYik]h\ci hiUW_bck iYX[Ya Ybh'

IBGK [fcidg'd'U[]Uf]ga]bhc'h\Y'Zc``ck]b['WUhY[cf]Yg.

• i bXYfgHJbX'mci f'f][\hg'UbX'fYgdcbg]V]`]h]Yg'Ug'U'gh XYbh'Uhil BGK

5WUXYa]W±bZcfaUhjcb

: cf'YggYbhJU`ghi XYbh]bZcfa UhJcb'fY`UhJb['lc.