

## CO LD AD I OFY BOAFD HELP NJ A OID LA -MIN E B DGE HOF FALL?

| DECEMBEF 13, 2018

LUk a U\_Yfg UfY \cd]b[ hc ]a d`Ya Ybh WcbgYbgi g ZcfYWUgh]b[ hc \_YYd ghUhY cb Yj Yb Z]bUbW]U` \_YY`, Vi h [cj Yfbcf k ci `X gh]`` VY cb`mcbY k \c Wci `X Wffh]ZmghUhY fYj Ybi Yg



 $LUk\ a\ U_Yfg\ UfY\ Vcbg]XYf]b[\ U\ Wk\ Ub[\ Y\ ]b\ k\ h\ Y\ ghUhY\ ZcfYWUghg\ hUl\ Wc``YVWi]cbg\ YUWk\ nYUf\ -k\ \]Wk\ ]g\ _Ymhc\ XYhYfa\ ]b]b[\ ghUhY\ gdYbX]b[\ -]b\ h\ Y\ bUa\ Y\ cZ\ ]a\ dfcj\ ]b[\ Z]gWU\ dc`]WM\ Bi\ h\ Yj\ Yb\ ]Z\ ]h\ ]g\ UXcdhYX,\ Gcj\ .\ P\]`\ Mi\ fd\ k\ ci\ `X\ gh]``\ fYhU]b\ gc`Y\ Ui\ h\ cf]hmhc\ g][\ b\ cZZ\ cb\ fYj\ Ybi\ Yg\ Zcf\ h\ Y\ ghUhY\ Vi\ X[\ Yh\ ]$ 

 $EUf^]Yf h\]g mYUf, YbUhY PfYg]XYbh hYj Y k YYbYmZcUhYX h\Y ]XYU cZ WfYUh]b[ U gdYW]U^ VcUfX a UXY i d cZ cZZ]W]U^g fYdfYgYbh]b[ Vch\ h\Y LY[]g`Uhi fY UbX h\Y [cj Yfbcf hc WYfh]Zm$ 

 $\label{thm:ck.vi} $$ \ck \'Uf[Y h\Y Vi X[Yh g\ci `X VY YUW\ mYUf. \ \uh]XYU k Ug bYj Yf YbUWhYX. Nck , \ck Yj Yf, h\Y AggYa V`mBi X[Yh Wca a ]hhYY \Ug []j Yb ]hg V`Ygg]b[ hc U V]`` h\Uh k ci `X YghUV`]g\ U fYj Ybi Y-UXj ]gcfm VcUfX. Ihg di fdcgY: Vf]b[ hc[Yh\Yf ZcfYWUgh]b[ Yl dYfhg Zfca h\Y Yl YW h]j Y UbX `Y[]g`Uh]j Y VfUbW\Yg, Ug k Y`` Ug U j c]WY Zfca ci hg]XY [cj Yfba Ybh$ 

 $\hat{I} = Y + i gY + cZ + U + w + bgY + bgi g = g + h + cX + hc + Ygh] = U + Y + Ygh + V + Ygh +$ 

Fcf h\Y dUgh gYj Yb XYWUXYg. NYk JYfgYmg Ubbi U` Vi X[Yh dfcWYgg \Ug cdYfUhYX VUg]\W\`mh\Y gUa Y k Umi bXYf U gnghYa YghUV`]g\YX ]b h\Y ghUhY Wcbgh]hi h]cb. Ih []j Yg`Uk a U\_Yfg h\Y dck Yf hc k f]hY h\Y Ubbi U` Uddfcdf]Uh]cbg V]``, Vi h Uk UfXg hc h\Y [cj Yfbcf h\Y gc`Y Ui h\cf]hmhc WYfh]Zm\ck a i W\ hUl fYj Ybi Y k ]`` VY Uj U]`UV`Y Xi f]b[ h\Y Z]g\W\` mYUf hc gi ddcfh gdYbX]b[. \Y Wcbgh]hi h]cb U`gc fYei ]fYg U VU`Ub\WX Ubbi U` Vi X[Yh, a YUb]b[ dfc^Y\WYX fYj Ybi Yg a i gh a Uh\W. ZcfY\WghYX gdYbX]b[ k \Yb U bYk Z]g\W\` mYUf VY[]bg cb Ji `m1.

Ag dUfh cZ h\Y Vi X[Yh dfcWrgg, h\Y DYdUfha Ybh cZ fYUgi fmWca d]`Yg U g\cfh Z]gWU` ci h`cc\_ UbX fYj Ybi Y ZcfYWUgh YUWX k ]bhYf. \Y ghUhY hfYUgi fYf Wca Yg VYZcfY `Uk a U\_Yfg hk ]WY YUWX gdf]b[ hc fYj ]Yk h\Y ZcfYWUgh UbX a U\_Y UbmWXUb[Yg, ]Z bYWYggUfm, VUgYX cb hUl -Wc``YWh]cb hfYbXg. A fYj Ybi Y ZcfYWUgh ]g U`gc dfYdUfYX YUWX mYUf Vmh\Y Vi X[Yh UbU`mgh Zcf h\Y OZZ]WY cZ LY[]g`Uh]j Y Yfj ]WYg, h\Y ghUhY LY[]g`Uhi fY'g bcbdUfh]qUb fYgYUfWX Ufa, Vi h ]h'g cb`mUXj ]qcfm]b bUhi fY.

EUf`]Yf h\]g mYUf, h\Y [cj Yfbcf'g Ui h\cf]hmhc WYfh]ZmfYj Ybi Yg Ya Yf[YX Ug U \_YmZUi `h`]bY ]b

Vi X[Yh X]gdi hYg ]bj c`j ]b[ Mi fd\m, U Z]fgh-hYfa DYa cWfUh, k YYbYm(D-G`ci WYghYf), UbX AggYa V`m

dYU\_Yf CfU][ Cci [\`]b (D-M]XX`YgYI) h\Uh bYUf`mg\i h Xck b ghUhY [cj Yfba Ybh. Ah h\Y \YUfh cZ h\Y

X]gU[fYYa Ybh k Ug`Y[]g`Uh]j Y `YUXYfg fY`i WhUbWY hc YbUWh Ub Ua V]h]ci g hUl -\]\_Y U[YbXU h\Uh

Mi fd\mdfcdcgYX ]b cfXYf hc Zi bX U \cgh cZ gdYbX]b[ df]cf]h]Yg. Ib h\Y YbX, h\Y `Y[]g`Uh]j Y `YUXYfg

hc g\W'Y VU\W\_\]g dfcdcgYX hUl \]\_Yg, Vi h h\Y [cj Yfbcf i gYX h\Y fYj Ybi Y

WYfh]Z]\Wh]cb fYei ]fYa Ybh Ug`Yj YfU[Y hc dfYj Ybh`Uk a U\_Yfg Zfca VUg]b[ h\Y Vi X[Yh cb gca Y

gi gdY\M gci f\W'g cZ fYj Ybi Y.

 $\label{thm:continuous} Yj YfU' k YY_g UZhYf h\Y Xi gh gYhh`YX, h\Y YbUhY Bi X[Yh UbX Addfcdf]Uh]cbg Cca a ]hhYY \Y`X U \YUf]b[ cb h\Y dfcdcgU' hc YghUV`]g\ U WcbgYbgi g-fYj Ybi Y ZcfYWUgh]b[ dfcWYgg j ]U Wcbgh]hi h]cbU' Ua YbXa Ybh bXYf h\Uh , U Î fYj Ybi Y Wfh]Z]WUh]cb VcUfXÏ k ci `X VY UggYa V`YX hc [Yh ]bdi h Zfca h\Y ghUhY hfYUgi fYf UbX h\Y OL Vi X[Yh cZZ]WYf, Ug k Y`` Ub ci hg]XY YWcbca ]Wdc`]WmYl dYfh. Mcgh ]a dcfhUbh`m, h\Y Wcbgh]hi h]cb k ci `X VY fYk f]hhYb hc []j Y h\Y bYk VcUfX h\Y Ui h\cf]hmhc WYfh]ZmfYj Ybi Yg.$ 

 $k \ YYbYmV]hYX \ fYgYUfW. \ Vmh\ Y \ c`W\_Yf \ A``]UbWf \ h\ Uh \ ]bX]WUhYX \ bYUf`m \qquad U`fYUXmi gY U \ WcbgYbgi g-ZcfYWUgh]b[ a cXY` hc gi ddcfh \]g dfcdcgU`, Vi h \ hUhY \ fYUgi fYf E`]nUVYh\ MU\Yf Mi c]c gi Va ]hhYX U `YhhYf h\ Uh fU]gYX \ WcbWffbg UVci h \ ck \ h\ Y \ dfcdcgYX \ Wcbgh]hi \ h]cbU` Ua YbXa Ybh — k \]W. k ci `X bch bYYX Uddfcj U` Zfca \ h\ Y [cj Yfbcf — Wci `X i dgYh \ h\ Y cj YfU` gmghYa cZ W.YW\_g UbX VU`UbWfg YghUV`]g\ YX \ ]b \ h\ Y \ ghUhY \ Wcbgh]hi \ h]cb.$ 

 $\label{thm:condition} $$ \Y \] ggi Y X]YX Xck b UZhYf h\Y dfcdcgYX Ua YbXa Ybh dUggYX h\Y Zi `` YbUhY Vi h X]Xb' h [c Ubmk \YfY] b h\Y AggYa V`m, k \YfY Mi c]c \UX gYfj YX i bh]` ^c]b]b[ h\Y Mi fd\mUXa ]b]ghfUh]cb YUf`]Yf h\]g mYUf. Bi h Ya Yf[]b[ ci h cZ h\Y AggYa V`mBi X[Yh Cca a ]hhYY `Ugh k YY_k Ug h\Y h\Uh k ci `X YghUV`]g\ h\Y fYj Ybi Y-UXj ]gcfmdUbY` Vm`Uk UbX bch Wcbgh]hi h]cbU` Ua YbXa Ybh, `YUj ]b[ Mi fd\mg Wcbgh]hi h]cbU` dck Yfg i bhci W\YX. h]``, hc []j Y h\Y UXj ]gcfmVcUfX gca Y hYYh\, h\Y V]`` k ci `X Wca dY` h\Y [cj Yfbcf hc Yl d`U]b UbmX]ZZYfYbWfg VYhk YYb h\Y WcbgYbgi g ZcfYWUgh UbX \]g UXa ]b]ghfUh]cb' g$ 

 $\begin{tabular}{ll} $$ $ \begin{tabular}{ll} $ $ \begin{tabular}{ll} $ \begin{tabular$ 

 $\begin{tabular}{ll} $$ \YV]^* & Ug Z]fgh ] bhfcXi WYX ] b JUbi Ufm, UbX cbY cZ ] hg YUf^mWc-gdcbgcfg & Ug Mi c]c. Ib U ghUhYa Ybh ] ggi YX mYghYfXUm, g\Y WU^YX fY^]UV^Y fYj Ybi Y Ygh]a UhYg Î YggYbh]U^hc Vi ]^X]b[ U Z]gWU^m fYgdcbg]V^Y Vi X[Yh. I$ 

Î MUbmUfY bch Uk UfY h\Uh U \YU'h\m, We``UVcfUh]j Y dfcWYgg U`fYUXmYI ]ghg VYhk YYb h\Y dfcZYgg]cbU`ghUZZg cZ Vch\ h\Y YI YW h]j Y UbX `Y[]g`Uh]j Y VfUbWXYg.Ï g\Y gU]X. Î Ag U Zcfa Yf Wegdcbgcf cZ h\]g `Y[]q`Uh]cb, I k Y`Wea Y h\Y cddcfhi b]hmhc Vi ]`X i dcb h\]g YI ]qh]b[ fY`Uh]cbq\]d.Ï

 $\label{eq:continuous} $$ Y = a \cdot Y =$ 

 $\label{thm:linear} NYk JYfgYm`Uk a U_Yfg \Uj Y hf]YX VYZcfY hc \qquad U WcbgYbgi g-ZcfYWUgh]b[ VcUfX, Vi h U`h\ci [\Uddfcj YX VmVch\ \ci gYg cZ h\Y LY[]g`Uhi fY ]b 2015, ]h k Ug i `h]a UhY`mj YhcYX Vmh\Y FYdi V`]WUb C\f]gh]Y.$