



([SODLQ WKH 'LVWULFW] R WDKV WHWDVQPHQDQWGLF W GO BI Q B OG L V W U ,PSOHPHQW VWUDWQHJZIHWKRWS B FIDIQE VWXGVHGXW E HKDYLRL 3ODQ FRQGXFW RDQSGDUH QDWFFVR QIHUHQFH V .QRZ DQG VXFFFHVIXW\LSQDWKHL F7LHSDDFKHUF HWD/OXDWLRLQ 3U 2UJDQLJH WKH SKVLFDD PFDQQQMURVRIRDIAQHQWDQIRBIVQLVQXG 8WLOLJH WHDFKLQJ QJDWJHUVWQG HAQWDWLQ QLQQJGV RQ OHD 'LVFXVV SUREOHP VRIOYLOQHFHWVUDUWHIRLU QDRSHUFDWDVRQRR 5HTXHVW DVVLVWDQFH ZKHQ QHHGHG &RPPXQLFDWH ZLWK FUKHDQMVH QQLQJSR GXFWL YH PDQQHU ([SODLQ WKH QHFHVVELHWWZRHHQDW\BQEHE SHIWWR/QBQDDQGLSYH .QRZ DQG XWLOLJH WKH YDULRXV 'LV

([SODLQ DQG LPSOMP HFOVLD VHVLHFRPL P DQDJHP JHDQW RDQDGO R U J D
 VWUDWHJLHV FRQWLQXDWLRLQ IURP %(*, 1,
 8WLOL]H WHDFKLQJ SLLQRFFUHQDXUHH M QWJD W/G WLPH RQ WDVN
 , GHQWLIV DQG DSSO\SVWQ DOWHHJLRHQVWZL WWH DQPB SQWRISIULD
 ULJRU
 , GHQWLIV DQG XWLQ\LFH PRRPGLR GFDDWLLRRQ WWWUXDGMHQJW VZ ILRUK
 VSHFLDO OHDUQLQJ QHHGV
 ([SODLQ DQG LPSOHPIQWQ DRVBDODHDWVHV VHPQHQ WHBHQ 6 DVFMX
 VWUDWHJLHV
 8WLOL]H GDWD IURP LQIRUPDO DVVHVVPHQWV WR SODQ L
 , GHQWLIV DQG XWVOMJ BWHHLHFLW L1RHU VNLMOHQ WQROSGDHF WUL
 DQG KRPHZRUN
 ([SODLQ DQG LPSOH PHWQXNG HHQIW FHWQJYDHJ HPHQSAB WLUQJW HJLHV
 ZULWLQJ PRYHPHQW
 , GHQWLIV H[SODLQ BIQIGH FLW S\YH RHWQMD WBIQLBFDG R PFLUFH DWH
 OHDUQLQJ HQYL3RQ8RQMMXD \$FDGHPLF :DOOV
 ([SODLQ DQG LPSQHWPKHQWQ G*WHRW' VWUDWHJLHV
 3UREOHP VROYHV VQWHUFDWMDU\ IRUGDLO\ FQWDVVURRP RSHU
 5HTXHVW DVVLVWDQFH ZKHQ QHHGHG

% (*, 1,,,

7KH %(*, 1,,, 3URJUDP IIRU QHHVDBQHGV ZKR HKD YHK FRIPE SOWWWZ
 OHYHOV RI WKH %(*, KHS IURJHFDPRI U RI 3URORHVSPLHQQD CHHYBFH
 LV WKH SURJUDP IDFRORP DWDVRRU%(*7KHJ, HLGV LVQW DXPFRWUH
 FROODERUDWLYH IRUWDQWHZQWKHOU RWRXSLQJ RI SDUWLFL

WHDFKHUV IURP WKH \WQRG XFRKWL RQP\\$ KDWHQ B V IE XRLOV\ KQ \ US K
FDUHHUV DQG LQWRHW:KDQ\ Q \ WR QI 6WKRRO 'L V W U L F W

%(*,1,,, 7HDFKHU_2XWFRPHV

7KH %(*,1,,, WHDFKHU ZLOO EH DEOH WR

\$SSO\ WKH VNLOO R\ HU HPS\ R\ W\ R\ Q\ QMR R\ V\ O\ D\ X\ F\ W\ B\ R\ Q\ D\ Q\ G
SURIHVVLRQDO JURZWK
'HILQH WHDFKHU OH D G\ HW V\ K\ L\ S\ DD\ Q\ G\ V\ K\ R\ B\ Z\ G\ R\ K\ X\ W\ U\ R\ W\ R\ O\ K\ H\ L\ Q\ D\ Q\ G\ S\ O\ D\ Q\ Q
FODVVURRP
'HPRQVWUDWH HIIHF\ LYH FRPPXQLFDWLRQ VNLOOV
'HDOLQJ DQG UHVROYLQJ FRQIOLFW VLWXDWLRQ
6HWWLQJ QRUPV IRU J\ L\ R\ Q\ X\ F\ Q\ Q\ Q\ ERQ\ Q\ V\ D\ D\ Q\ G\ S\ O\ D\ Q\ Q
LQVWUXFWLRQ
([SODLQ DQG DSSOU\ RS\ I\ N\ Z\ N\ U\ R\ Q\ Q\ S\ G\ H\ Y\ H\ O\ R\ S\ P\ V\ H\ Q\ G\ W\ R\ Q\ H\ M\ I\ R\ J\ Q\ V
HPEHGGHG OHDUQLQJ
'HPRQVWUDWH D YDULHW\ RI ZD\ V\ WR FRQGXFW GDWD PH
0RGHO EDVLF IDFLQ\ HW DQ\ M\ F\ R\ Q\ WD\ W\ U\ D\ Q\ H\ W\ K\ H\ U\ R\ D\ O\ H\ O\ R\ I\ D\ G\ H\ I\ U
([SODLQ KRZ WR SD\ K\ H\ W\ S\ B\ R\ S\ B\ W\ H\ R\ Q\ E\ W\ L\ Q\ G\ F\ L\ R\ Q\ P\ D\ X\ Q\ L\ H\ W\ U\ Q\ L\ Q
&RQGXFWLQJ FUXFLDO FRQYHUV DWLRQV KD Q G I\ E\ L\ X\ F\ C\ O\ G\ L\ Q\ J\ U
WHDPDW\ HV
\$SSO\ WKH SULQFL SCQ\ H\ V\ S\ R\ J\ R\ W\ K\ W\ V\ F\ W\ B\ W\ K\ H\ L\ Q\ J\ F\ X\ D\ U\ Q\ G\ H\ Q\ W\ V\ H
VLWXDWLRQV
5HTXHVW DVVLVWDQFH ZKHQ QHHGHG

3DUWLFLSDWLRQ LQ \WPKH L% (*,1, Q Y\ L\ W\ RD\ J\ W\ L\ R\ Q\ \W\ O\ W\ DR\ Q\ S\ H\ Q\ H\ R\ M\ F\ O\ P\ X\ M\ D\ L\ RI\ R\ W\ K\ H\ U\ Q\ H\ Z\ O\ \ K\ L\ U\ R\ I\ Q\ \W\ Q\ H\ D\ Q\ F\ K\ H\ G\ V\ D\ Z\ K\ L\ V\ W\ B\ Q\ W\ H\ D\ Q\ G\ Q\ A\ X\ S\ S
KLUHG WHDFKHUV ZLW\ D\ U\ W\ Z\ R\ I\ R\ H\ S\ P\ R\ U\ L\ H\ H\ Q\ F\ S\ H\ D\ W\ B\ \ L\ S\ Q\ D\ M\ W\ K\ H\ F\ %(*,1,
\$JDLQ 3URJUDP RU S\ H\ W\ B\ W\ L\ V\ R\ Q\ U\ R\ Q\ W\ H\ W\ K\ H\ W\ H\ W\ Z\ R\ P\ H\ W\ K\ R\ G
1HZ WHDFKHUV ZLWK H\ Q\ S\ H\ W\ H\ L\ HD\ Q\ F\ R\ H\ U\ P\ R\ L\ P\ Q\ S\ W\ K\ H\ F\ H\ X\ P\ D\ Q\ 5\ H\ V\ R\ X
'HSDUWPHQW H[SODLQ\ L\ Q\ Q\ G\ M\ W\ W\ R\ H\ Q\ D\ P\ R\ B\ H\ O\ H\ D\ G\ Z\ M\ K\ H\ O\ E\ H
RSSRUWXQLW\ WR S\ K\ H\ U\ W\ W\ F\ K\ H\ S\ B\ W\ T\ H\ 1\ L\ Q\ B\ L\ Q\ S\ H\ W\ R\ L\ W\ D\ R\ Q\ R\ U\ Q\ W\ R\ X
W\ K\ H\ %(*,1,, SURJUDP
3ULQFLSDOV PD\ F\ R\ Q\ W\ D\ F\ W\ W\ K\ H\ 3\ U\ R\ I\ H\ V\ V\ L\ B\ Q\ M\ D\ O\ D\ H\ Y\ H\ O\ R\ S\ P\ U\ H\ T\ X\ H\ V\ W\ I\ R\ U\ D\ Q\ H\ Z\ R\ Q\ W\ H\ Z\ S\ L\ H\ W\ K\ H\ S\ Q\ F\ H\ H\ W\ W\ R\ Q\ S\ V\ D\ K\ H\ H\ B\ F\ L\ S\ D\ W\ H\ 3\ U\ R\ J\ U\ D\ P\ E\ D\ V\ H\ G\ R\ Q\ F\ X\ U\ W\ W\ S\ Q\ W\ R\ Q\ H\ G\ H\ D\ G\ W\ B\ Q\ G\ B\ Q\ H\ G\ Q\ L\ F\ R\ I\ P\ H\ R\ I\ Q\ W\ Q\ O\ H\ [S\ H\ U\ L\ H\ Q\ F\ H

1HZ\ KLUHG WHDFKHUV D\ Z\ N\ H\ Q\ O\ 2\ S\ F\ D\ W\ U\ W\ L\ F\ F\ K\ L\ H\ S\ D\ W\ K\ H\ S\ L\ S\ Q\ W\ D\ W\ T\ H\ D\ 3\ U\ R\ J\ U\ D\ P\ D\ Q\ G\ Z\ L\ O\ O\ E\ H\ D\ V\ V\ L\ J\ Q\ H\ G\ W\ R\ D\ P\ J\ H\ Q\ D\ W\ G\ R\ H\ U\ W\ D\ Q\ Q\ D\ F\ K\ H\ U\ 7\ K\ H\ P\ H\ Q\ W\ R\ U\ W\ H\ D\ F\ K\ H\ W\ K\ H\ O\ O\ H\ Z\ H\ M\ H\ H\ D\ Z\ K\ W\ K\ H\ W\ D\ Q\ L\ F\ R\ I\ P\ H\ R\ I\ Q\ W\ Q\ O\ D\ V\ V\ L\ V\ W\ D\ Q\ F\ H\ Q\ H\ F\ H\ V\ V\ D\ W\ H\ D\ W\ F\ R\ K\ H\ U\ D\ S\ Q\ W\ K\ H\ 7\ K\ H\ K\ R\ I\ R\ D\ F\ K\ H\ D\ U\ Z\ L

5 H Y L V H G \$ X J X V W

E H R I I H U H G W K H R S S B E U M S D Q N L H W L Q V R V K S H D U A M Q * G X F W D R Q H 3 W R J U D
E H J L Q Q L Q J W K H I R O O R Z L Q J I D O O

7 K H U H D U H P D Q \ O D \ W U L V Q R : (6 V X S S J R Q H Z W H D B R H H U W V L R Q B O
' H Y H O R S P H Q W ' H S D U W I R H R Q W Q K D W U D F W W L D R Q D D O V & V R D F D K Q H V Q M E
W H D F K H U Z K R Z D R G X G O L G V D R Q B I O V X S S R U W B J W H T Q F H L V S A D Q W D D J H V R H
D V V L V W D Q F H I R U D % (* W K D S D U L W L H F L S S H D U Q V Q F I Z Q J V K G L M R L P F H
D V S H F W R I P D Q D J H P H Q W R U W H D F K L Q J

% (*, 1 6 8 3 3 2 5 7

% (*, 1 6 X S S R U W L V V W K I S S R W X W Q B Z W K R L U H V Z V W K H Q R K \$ Q H Y L R
H [S H U L H Q F H Z U K H R G D D I H V K I U 2 V W R X E H W R W K H R Q J R L Q J G H Y H O R
W K H I L U V W \ H D U W H D F K H U V L Q % (*, 1 , F B Q H U Z H I G L O I D V Z H W K L Q
\ H D U L V Q R W G H Y H O R H S F V H K Q I W D (O , A \ Z W H H D F U K H M K V U B H H P B Q W H K V R
W K H M R E 7 R S U R Y H Z G K L W K D Z M V O I D V Q I R Q [B B U L K H S Q F R H U Q H H M G K H
% (*, 1 6 X S S R U W 3 U R J U D P Z D V G H Y H O R S H G R (H D I S K H O L D H W Q H F H Q G H Z
L V P D W F K H G Z L W K D R M Q R H U R Z Q K R C H L C P O H Q X S S J R K U R V W M V H K P H W J K I W R V
R I W K H V F K R R O \ H D U W M R K I D R F X H J R H B W H L Q J V F H D P O Q Q V D Q I G R Q H
F O D V V U R R P Y L V L W V D V Q H H G H G \$ W W K U H V H M Q S D R U I W W Q B Q D K M

5 H Y L V H G \$ X J X V W