CS360 Supplemental Midterm, April 5, 2012. James S. Plank

Question 1

When the procedure below is executed, the state of memory is as pictured below to the right. The first three lines of output are drawn immediately below to the right. Tell me what the rest of the output is. The program was compiled in 32-bit mode, so that pointers are four bytes. Also, neither this nor the next program has a seg fault.

```
typedef unsigned int UI;

void q1(char **a, int **p)
{
  int i;
  int *b;
  char *c;

  printf("a: 0x%x\n", (UI) a);
  printf("p: 0x%x\n", (UI) p);
  printf("\n");

  for (i = 0; i < 5; i++) {
    printf("%d\n", (UI) p[i]);
  }
  printf("\n");

  for (i = 0; i < 5; i++) {
    printf("%s\n", a[i]);
  }
  printf("\n");

  for (i = 0; i < 5; i++) {
    printf("%d\n", *p[i]);
  }
  printf("\n");

  for (i = 0; i < 5; i++) {
    printf("%d\n", p[i][i]);
  }
  printf("\n");

  b = p[2];
  while (b < p[1]) {
    printf("%d\n", *b);
    b += 4;
  }
  printf("\n");

  c = a[4]-10;
  while (*c != '\0') {
    printf("%c", *c);
    c += 3;
  }
  printf("\n");
  printf("\n");

  a[3][5] = 'b';
  strcpy(a[3]+8, "Jet");
  printf("%s\n", a[3]);
}
```

The first three lines of output:

```
a: 0x100130
p: 0x10013c
```

State of Memory

Address	Value in decimal	Value in hex	Value as 4 chars
0x100110	1048784	0x1000d0	-- |'\0'| -- |'\0'
0x100114	0	0x0	'\0'|'\0'|'\0'|'\0'
0x100118	0	0x0	'\0'|'\0'|'\0'|'\0'
0x10011c	0	0x0	'\0'|'\0'|'\0'|'\0'
0x100120	0	0x0	'\0'|'\0'|'\0'|'\0'
0x100124	1048891	0x10013b	';' | -- | -- |'\0'
0x100128	1048887	0x100137	'7' | -- | -- |'\0'
0x10012c	1048898	0x100142	'B' | -- | -- |'\0'
0x100130	1048912	0x100150	'P' | -- | -- |'\0'
0x100134	1048919	0x100157	'W' | -- | -- |'\0'
0x100138	1048925	0x10015d	']' | -- | -- |'\0'
0x10013c	1048936	0x100168	'h' | -- | -- |'\0'
0x100140	1048956	0x10017c	'|' | -- | -- |'\0'
0x100144	1048908	0x10014c	'L' | -- | -- |'\0'
0x100148	1048904	0x100148	'H' | -- | -- |'\0'
0x10014c	1048900	0x100144	'D' | -- | -- |'\0'
0x100150	1936548211	0x736d6173	's' |'a' |'m' |'s'
0x100154	1677749871	0x64006e6f	'o' |'n' |'\0'|'d'
0x100158	1090544245	0x41006275	'u' |'b' |'\0'|'A'
0x10015c	1801550446	0x6b617a6e	'n' |'z' |'a' |'k'
0x100160	1801666816	0x6b634100	'\0'|'A' |'c' |'k'
0x100164	1349215041	0x506b6341	'A' |'c' |'k' |'P'
0x100168	1852138855	0x6e656567	'g' |'e' |'e' |'n'
0x10016c	1852375137	0x6e690061	'a' |'\0'|'i' |'n'
0x100170	1835091777	0x6d614741	'A' |'G' |'a' |'m'
0x100174	1277239653	0x4c212165	'e' |'!' |'!' |'L'
0x100178	1231383401	0x49656b69	'i' |'k' |'e' |'I'
0x10017c	1836015982	0x6d6f616e	'n' |'a' |'o' |'m'
0x100180	1952514153	0x74610069	'i' |'\0'|'a' |'t'
0x100184	1950949665	0x74492121	'!' |'!' |'I' |'t'
0x100188	1800368935	0x6b4f7327	''' |'s' |'O' |'k'
0x10018c	1232368962	0x49747542	'B' |'u' |'t' |'I'
0x100190	1852401748	0x6e696854	'T' |'h' |'i' |'n'
0x100194	1970231659	0x756f596b	'k' |'Y' |'o' |'u'
0x100198	1113944615	0x42657227	''' |'r' |'e' |'B'
0x10019c	1282634593	0x4c737361	'a' |'s' |'s' |'L'
0x1001a0	1315270249	0x4e656e69	'i' |'n' |'e' |'N'
0x1001a4	1935959397	0x73646565	'e' |'e' |'d' |'s'
0x1001a8	1751607636	0x68676954	'T' |'i' |'g' |'h'
0x1001ac	1768842612	0x696e6574	't' |'e' |'n' |'i'

Question 2

When the procedure below is executed, the state of memory is as pictured below to the right. The first three lines of output are drawn immediately below to the right. Tell me what the rest of the output is. The program was compiled in 32-bit mode, so that pointers are four bytes.

```
typedef unsigned int UI;

void q2(char **a)
{
  char **b;
  int i;
  int *p;
  int ****pp;
  char *c, *d;
  unsigned int *q;

  printf("0x%x\n", (UI) a);
  printf("\n");

  for (i = 0; i < 5; i++) {
    printf("0x%x\n", (UI) a[i]);
  }
  printf("\n");

  b = a;
  for (i = 0; i < 5; i++) {
    printf("%s\n", *b);
    b += 2;
  }
  printf("\n");

  p = (int *) a;
  p -= 10;
  for (i = 0; i < 5; i++) {
    printf("0x%x\n", p[i]);
  }
  printf("\n");

  pp = (int ****) (&a[11]);
  printf("0x%x\n", (UI) pp);
  printf("0x%x\n", (UI) *pp);
  printf("0x%x\n", (UI) **pp);
  printf("0x%x\n", (UI) ***pp);
  printf("0x%x\n", (UI) ****pp);
  printf("\n");

  q = (UI *) (a[13]);
  c = a[13];
  d = c;
  for (i = 0; i < 8; i++) {
    d = d + (q[i]%4);
    c[i] = *d;
  }
  printf("%s\n", c);
  printf("\n");

  c++;
  p = (int *) c;
  printf("0x%x\n", *p);
}
```

The first two lines of output:

```
0xbfffddcc
```

State of Memory

Address	Value in decimal	Value in hex	Value as 4 chars
0xbfffdd6c	989883711	0x3b006d3f	'?' |'m' |'\0'|';'
0xbfffdd70	744816749	0x2c65006d	'm' |'\0'|'e' |','
0xbfffdd74	1634498155	0x616c766b	'k' |'v' |'l' |'a'
0xbfffdd78	1752760441	0x68790079	'y' |'\0'|'y' |'h'
0xbfffdd7c	1983603064	0x763b6178	'x' |'a' |';' |'v'
0xbfffdd80	1966828544	0x753b6c00	'\0'|'l' |';' |'u'
0xbfffdd84	660761461	0x27626b75	'u' |'k' |'b' |'''
0xbfffdd88	1651666549	0x62726e75	'u' |'n' |'r' |'b'
0xbfffdd8c	15163	0x3b3b	';' |';' |'\0'|'\0'
0xbfffdd90	1651143009	0x626a7161	'a' |'q' |'j' |'b'
0xbfffdd94	1811966065	0x6c006871	'q' |'h' |'\0'|'l'
0xbfffdd98	2020278272	0x786b0000	'\0'|'\0'|'k' |'x'
0xbfffdd9c	654336634	0x2700627a	'z' |'b' |'\0'|'''
0xbfffdda0	1935892845	0x7363616d	'm' |'a' |'c' |'s'
0xbfffdda4	6946937	0x6a0079	'y' |'\0'|'j' |'\0'
0xbfffdda8	2019651943	0x78617167	'g' |'q' |'a' |'x'
0xbfffddac	654342777	0x27007a79	'y' |'z' |'\0'|'''
0xbfffddb0	778268281	0x2e636e79	'y' |'n' |'c' |'.'
0xbfffddb4	3014761	0x2e0069	'i' |'\0'|'.' |'\0'
0xbfffddb8	2036754274	0x79666762	'b' |'g' |'f' |'y'
0xbfffddbc	2037132288	0x796c2c00	'\0'|',' |'l' |'y'
0xbfffddc0	1883205233	0x703f6e71	'q' |'n' |'?' |'p'
0xbfffddc4	30569	0x7769	'i' |'w' |'\0'|'\0'
0xbfffddc8	1684237177	0x64636b79	'y' |'k' |'c' |'d'
0xbfffddcc	-1073750653	0xbfffdd83	-- | -- | -- | --
0xbfffddd0	1919774056	0x726d6d68	'h' |'m' |'m' |'r'
0xbfffddd4	-1073750667	0xbfffdd75	'u' | -- | -- | --
0xbfffddd8	1764191744	0x69276e00	'\0'|'n' |''' |'i'
0xbfffdddc	-1073750635	0xbfffdd95	-- | -- | -- | --
0xbfffdde0	1868955648	0x6f660000	'\0'|'\0'|'f' |'o'
0xbfffdde4	-1073750649	0xbfffdd87	-- | -- | -- | --
0xbfffdde8	1060006256	0x3f2e6970	'p' |'i' |'.' |'?'
0xbfffddec	-1073750623	0xbfffdda1	-- | -- | -- | --
0xbfffddf0	2019847424	0x78646d00	'\0'|'m' |'d' |'x'
0xbfffddf4	-1073750668	0xbfffdd74	't' | -- | -- | --
0xbfffddf8	-1073750532	0xbfffddfc	-- | -- | -- | --
0xbfffddfc	-1073750540	0xbfffddf4	-- | -- | -- | --
0xbfffde00	-1073750652	0xbfffdd84	-- | -- | -- | --
0xbfffde04	27438	0x6b2e	'.' |'k' |'\0'|'\0'
0xbfffde08	662241394	0x27790072	'r' |'\0'|'y' |'''