

**The University of Queensland
School of Information Technology and Electrical Engineering
Semester 1, 2009**

COMP2303 COMP7306

SAMPLE MID-SEMESTER EXAM QUESTIONS

21. Consider the following C code fragment:

```
int a,b,c;  
  
a=2;  
b=3;  
c=5;  
a += c%b++;
```

What is the value of a after the execution of this code fragment?

- (a) 2
 - (b) 3
 - (c) 4
 - (d) 5
 - (e) None of the above
22. Consider the following C code fragment:

```
int a,b,c;  
  
a=2;  
b=3;  
c=9;  
a *= --c/b;
```

What is the value of a after the execution of this code fragment?

- (a) -1
 - (b) 2
 - (c) 4
 - (d) 6
 - (e) None of the above
23. Consider the following C code fragment:

```
char s[] = { 'c', 'o', 'm', 'p', '7', '3', '0', '6', '\\0' };  
char c[10] = "comp2303";  
char *p;  
  
p = &s[2];
```

Which of the following expressions is false?

- (a) `strlen(c) == strlen(s)`
- (b) `c[8] == s[8]`
- (c) `*p == c[2]`
- (d) `*(p+3) == c[5]`
- (e) None of the above

24. Consider the following C code fragment:

```
char c[10] = "comp2303";  
char *p;  
  
p = &c[1];
```

Which of the following expressions is false?

- (a) `c[8] == '3'`
- (b) `p[0] != 'c'`
- (c) `*p == c[1]`
- (d) `*(p+4) == c[7]`
- (e) None of the above

Questions 25 to 27 apply to the following valid C code fragment:

```
int a, b[2], c, *ptr;  
char* str = "comp7306";  
  
a = 3;  
b[0] = 5;  
b[1] = 7;  
c = 13;  
ptr = &b[0];  
  
c -= a++;  
*ptr++ = 9;
```

25. What is the value of `c` after the execution of this code fragment?

- (a) 3
- (b) 4
- (c) 9
- (d) 10
- (e) None of the above

26. What is the value of `*ptr` after the execution of this code fragment?

- (a) 5
- (b) 6
- (c) 7
- (d) 9
- (e) None of the above

27. Which of the following expressions is considered to be false in C? (All expressions are valid.)

- (a) `strlen(str)-9`
- (b) `*(str+6)`
- (c) `*str - 'c'`
- (d) `str`
- (e) None of the above

The following applies to questions 28 and 29:

A computer system requires natural alignment and items of type character, short, int, long, float, double and pointers occupy 1, 2, 4, 8, 4, 8 and 8 bytes respectively.

28. What is the result of `sizeof(char*[5])` ?
- (a) 5
 - (b) 8
 - (c) 16
 - (d) 20
 - (e) None of the above
29. What is the result of `sizeof(union {struct {char c[2];double d;} s1; int i; struct {short x[2]; float f[3];} s2;})` ?
- (a) 4
 - (b) 8
 - (c) 16
 - (d) 30
 - (e) 32

The following applies to questions 30 and 31:

A computer system requires natural alignment and items of type character, short, int, long, float, double and pointers occupy 1, 2, 4, 4, 4, 8 and 4 bytes respectively.

30. What is the result of `sizeof(struct {char* names[5]; double cost; char tag;})`?
- (a) 32
 - (b) 36
 - (c) 40
 - (d) 56
 - (e) None of the above
31. What is the result of `sizeof(struct {char c[2]; union {char c; int i;} u; int i[3]; })` ?
- (a) 12
 - (b) 20
 - (c) 24
 - (d) 28
 - (e) None of the above
32. A computer system requires natural alignment and items of type character, short, int, long, float, double and pointers occupy 1, 2, 4, 4, 4, 8 and 4 bytes respectively. What is the result of `sizeof(struct {short s; double d; union {int i; char c;} u;})` ?
- (a) 14
 - (b) 16
 - (c) 20
 - (d) 24
 - (e) None of the above
33. Which of the following best describes the type of `var` in the following declaration?
- ```
int *(*var)(int)
```
- (a) A pointer to a pointer to a function taking no arguments and returning an integer
  - (b) A pointer to a function taking an integer argument and returning an integer
  - (c) A pointer to a function taking an integer argument and returning a pointer to an integer
  - (d) A function which takes an integer argument and returns a pointer to an integer
  - (e) None of the above

34. What will be printed when the following code is executed?

```
#include <stdio.h>
int x = 2;
int y = 4;

int fn(int y)
{
 x+=y;
 printf("%d %d ", x, y);
 y=y*y;
 return y;
}

int main(void)
{
 int x=0;

 x = fn(3);
 y++;
 printf("%d %d\n", x, y);
 return 0;
}
```

- (a) 3 3 9 5
- (b) 5 3 9 5
- (c) 5 3 9 10
- (d) 6 4 16 17
- (e) None of the above

35. Consider the following C program:

```
#include <stdio.h>
int main(int argc, char* argv[])
{
 argc--;
 ++argv;
 if(*argv)
 {
 while(argv[0][0] == '-' && argv[1] && argv[2])
 {
 argc-=2;
 argv+= 2;
 }
 printf("%s\n", *argv);
 }
 else
 {
 printf("No arguments\n");
 }
 return 0;
}
```

If the program is compiled to an executable called a.out in the current directory, what is the result of running

```
./a.out -one -two -three -four
```

- (a) No arguments
- (b) -one
- (c) -two
- (d) -three
- (e) -four

36. What is printed as a result of the following code?

```
int i, j, k;
k=0;
for(i=0; i < 6; i++) {
 j=10-i;
 if(i%2) {
 continue;
 }
 while(j) {
 if(j==i) {
 printf("%d", j);
 break;
 }
 j--;
 }
 printf("%d", i);
}
printf("%d\n", i);
```

- (a) 01
- (b) 0246
- (c) 022446
- (d) 02244668
- (e) None of the above

37. What is printed as a result of the following code?

```
int i, j = 0, k = 4;
for(i=0; i < 4; i++) {
 switch(i)
 {
 case 3:
 j++;
 continue;
 case 2:
 break;
 case 1:
 j = k;
 default:
 j++;
 }
 j++;
 printf("%d", j);
}
printf("%d\n", i);
```

- (a) 2564
- (b) 262
- (c) 2673
- (d) 2674
- (e) 26794



40. Which of the following best describes the type of `var` in the following declaration?

```
void (*var)(void*)
```

- (a) A pointer to a function taking no arguments and returning nothing
- (b) A pointer to a function taking an argument which is a pointer to anything and returning nothing
- (c) A pointer to a function taking an argument which is a pointer to nothing and returning nothing
- (d) A pointer to a function taking an argument which is a pointer to anything and returning a pointer to nothing
- (e) A pointer to a function taking an argument which is a pointer to anything and returning a pointer to anything

41. Consider the following structure definitions and variable declarations:

```
struct Point {
 double x, y;
};
struct Polygon {
 int numSides;
 struct Point* vertices;
};
```

```
struct Polygon poly;
struct Point *p;
```

and the following associated statements:

```
poly.numSides = 4;
poly.vertices = malloc(poly.numSides * sizeof(struct Point));
p = poly.vertices + 1;
poly.vertices[0].x = 1.0;
poly.vertices[0].y = 1.0;
poly.vertices[1].x = 3.0;
poly.vertices[1].y = 4.0;
poly.vertices[2].x = 1.0;
poly.vertices[2].y = 6.0;
poly.vertices[3].x = -1.0;
poly.vertices[3].y = 4.0;
```

Which of the following expressions is both valid and true?

- (a) `(p-1)->x == (p+1)->x`
- (b) `*p == &poly.vertices[1].x`
- (c) `*p == poly.vertices[1].x`
- (d) `poly.vertices[2].x == p->y`
- (e) None of the above

42. Consider the following structure definitions and variable declarations:

```
struct Point {
 double x, y;
};

struct Rectangle {
 struct Point lowerLeft;
 struct Point upperRight;
};
```

```
struct Rectangle r;
struct Rectangle *p;
```

and the following associated statements:

```
p = &r;
r.lowerLeft.x = 0;
r.lowerLeft.y = 0;
r.upperRight.x = 5;
r.upperRight.y = 10;
```

Which of the following expressions is both valid and true?

- (a) `r->x == r->y`
- (b) `p->lowerLeft->x == r.lowerLeft.x`
- (c) `&(r.lowerLeft) == p->lowerLeft`
- (d) `&(r.lowerLeft.x) == (double*)p`
- (e) None of the above

43. Consider the following structure definitions and variable declarations:

```
struct Point {
 double x, y;
}
struct Circle {
 double radius;
 struct Point centre;
}
struct Circle c;
struct Circle *p;
```

and the following associated statements:

```
p = &c;
c.centre.x = 10;
c.centre.y = 10;
c.radius = 3.03;
```

Which of the following expressions is both valid and true?

- (a) `p->c.x == p->c.y`
- (b) `p.centre->x == c.centre.y`
- (c) `&(c.centre.x) == p->centre.x`
- (d) `&(c.radius) == &(p->radius)`
- (e) None of the above

44. If the current directory is `/tmp`, which of the following path names is **not** equivalent to `/var/log/mail.log`?

- (a) `../var/log/mail.log`
- (b) `/var/../../var/log/../../log/mail.log`
- (c) `./var/./log/mail.log`
- (d) `../../../../var/log/mail.log`
- (e) All of the above are equivalent to `/var/log/mail.log`

45. If the current directory is `/opt/local/lib/sparcv9`, which of the following path names is **not** equivalent to `/opt/local` ?
- `../..`
  - `../../../../local`
  - `/opt/./opt/local`
  - `../../../../././.`
  - All of the above are equivalent to `/opt/local`
46. If the current directory is `/students/39/comp2303`, which of the following path names is equivalent to `/students/37/smith`?
- `../smith`
  - `../../../../smith`
  - `../../../../students/37/smith`
  - `../../../../37/smith`
  - `../../../../37/smith`

47. Consider the following commands and output from a shell session (the commands typed by the user are shown in bold):

```
> pwd
/students/39/comp2303
> ls -ali
total 21
3213057 drwxrwx--x 5 comp2303 comp2303 512 Apr 18 12:39 ./
2732840 drwxr-xr-x 58 root sysadm 1536 Apr 15 13:26 ../
3213338 -rw----- 1 comp2303 comp2303 153 Mar 16 20:00 .Xauthority
3212960 -rw----- 1 comp2303 comp2303 782 Mar 16 20:04 .bash_history
3213110 -rw----r-- 2 comp2303 comp2303 13 Apr 14 12:01 .exrc
3213110 -rw----r-- 2 comp2303 comp2303 13 Apr 14 12:01 .vimrc
2657548 drwxrwx--x 239 peters comp2303 11264 Apr 6 13:37 a1/
1411148 drwxrwxr-x 3 peters comp2303 512 Apr 7 09:02 a2/
3367067 drwxr-xr-x 3 peters comp2303 512 Apr 18 02:05 a3/
3213196 lrwxrwxrwx 1 peters comp2303 5 Apr 18 12:39 vi.rc -> .exrc
```

The number in the left column is the i-node number. Which of the following commands would change the permissions on the `a3` subdirectory to be the same as those on the `a1` subdirectory

- `cp a1 a3`
  - `chmod 755 a3`
  - `chmod 771 a3`
  - `chmod 755 a1`
  - `chmod 771 a1`
48. Consider the scenario of question 47. Which of the following statements is true?
- `.vimrc` could have been created with the command `cp .exrc .vimrc`
  - `.vimrc` could have been created with the command `ln .exrc .vimrc`
  - `.vimrc` could have been created with the command `ln -s .exrc .vimrc`
  - Removal of `.exrc` will result in the removal of `.vimrc`
  - Removal of `vi.rc` will result in the removal of `.exrc`

49. Consider the following commands and output from a shell session (the commands typed by the user are shown in **bold**):

```
> pwd
/students/39/comp2303
> ls -ali
total 24
3213057 drwxrwx--x 8 comp2303 comp2303 512 Apr 21 21:09 ./
2732840 drwxr-xr-x 82 root sysadm 2048 Apr 16 09:50 ../
3214710 -rw----- 1 comp2303 comp2303 51 Apr 21 21:07 .Xauthority
3212960 -rw----- 1 comp2303 comp2303 1183 Apr 21 21:08 .bash_history
3213110 -rw-r--r-- 2 comp2303 comp2303 13 Apr 14 2005 .exerc
3213110 -rw-r--r-- 2 comp2303 comp2303 13 Apr 14 2005 .vimrc
 109282 drwx----- 6 peters comp2303 512 Mar 18 2006 2005/
3213204 drwx----- 9 peters comp2303 512 Mar 13 12:29 2006/
3213371 drwx----- 2 peters comp2303 512 Mar 13 12:24 2007/
3213195 drwxr-xr-x 2 peters comp2303 512 Apr 1 12:04 a1/
3213021 drwxrwx--x 201 peters comp2303 9728 Mar 22 22:01 a2/
 433382 drwxrwxr-x 3 peters comp2303 512 Apr 21 21:12 a3/
3213196 lrwxrwxrwx 1 peters comp2303 5 Apr 18 2005 vi.rc -> .exerc
```

The number shown in the left column is the i-node number. The only member of the 'comp2303' group is user 'peters'.

Which of the following statements is true?

- (a) There are 80 subdirectories in /students
  - (b) User 'comp2303' may create new files in /students/39/comp2303/a3
  - (c) User 'comp7306' can not list the contents of /students/39/comp2303 or any of its subdirectories
  - (d) User 'comp7306' can not read the contents of any files in /students/39/comp2303
  - (e) None of the above
50. Consider the scenario of question 49. Which of the following commands (executed by a user with sufficient privileges) would result in the permissions for /students/39/comp2303/a3 being changed to dr-x--x--x ?
- (a) chmod 311 /students/39/comp2303/a3
  - (b) chmod 511 /students/39/comp2303/a3
  - (c) chmod 622 /students/39/comp2303/a3
  - (d) chmod 711 /students/39/comp2303/a3
  - (e) None of the above
51. Consider the scenario of question 49. If a user with sufficient privileges executed the command **ln .exerc .exerc.bak**, which of the following lines could be part of a subsequent listing generated by **ls -ali**
- (a) 3213110 -rw-r--r-- 2 comp2303 comp2303 13 Apr 14 2005 .exerc.bak
  - (b) 3214999 -rw-r--r-- 2 comp2303 comp2303 13 Apr 14 2005 .exerc.bak
  - (c) 3213110 -rw-r--r-- 3 comp2303 comp2303 13 Apr 14 2005 .exerc.bak
  - (d) 3213110 -rw-r--r-- 2 comp2303 comp2303 14 Apr 14 2005 .exerc.bak
  - (e) 3214999 -rw-r--r-- 3 comp2303 comp2303 13 Apr 14 2005 .exerc.bak

52. Consider the following commands and output from a shell session (the commands typed by the user are shown in bold):

```
> pwd
/students/39/comp2303
> ls -al
total 19
drwxrwx--x 5 comp2303 comp2303 512 Apr 6 21:50 .
drwxr-xr-x 57 root sysadm 1536 Apr 6 16:05 ..
-rw----- 1 comp2303 comp2303 153 Mar 16 20:00 .Xauthority
-rw----- 1 comp2303 comp2303 782 Mar 16 20:04 .bash_history
-rw----- 1 peters comp2303 13 Apr 14 12:01 .exrc
drwxrwx--x 239 peters comp2303 11264 Apr 6 13:37 a1
drwxrwxr-x 3 peters comp2303 512 Apr 7 09:02 a2
drwx----- 2 peters comp2303 512 Apr 14 11:24 a3
```

The only member of the 'comp2303' group is user 'peters'.

Which of the following statements is false?

- (a) User 'xyz' may change into directory /students/39/comp2303 but may not list it  
 (b) User 'xyz' may not change into directory /students/39/comp2303/a3  
 (c) User 'peters' may not read the file /students/39/comp2303/.bash\_history  
 (d) The directory /students/39/comp2303/a3 has no subdirectories  
 (e) None of the above

53. Consider the scenario of question 52 where user 'peters' then executes

```
cd /students/39/comp2303
chmod 604 .exrc
ls -l .exrc
```

What will be the first 10 characters output?

- (a) -rw-----  
 (b) -r-x---r--  
 (c) -rwx---r--  
 (d) -rw----r--  
 (e) None of the above
54. Consider a UNIX file system with a disk block size of 4kbytes which uses i-nodes with triple-indirect. Each disk block pointer is 4 bytes long and the i-node contains 14 block pointers in total (11 direct block pointers, one single indirect, one double indirect and one triple indirect). What's the largest file that can be stored without using the double-indirect block pointer or the triple-indirect block pointer?
- (a) 44 kbytes  
 (b) 176 kbytes  
 (c) 4096 kbytes  
 (d) 4140 kbytes  
 (e) 16428 kbytes
55. Consider a UNIX file system with a disk block size of 2048 bytes which uses i-nodes with double indirect. Each disk block pointer is 4 bytes long and each i-node contains 15 disk block pointers in total (13 direct block pointers, one single indirect and one double indirect). What is the size of the largest file supported by this file system (approximately)?
- (a) 512MB  
 (b) 513MB  
 (c) 2048MB  
 (d) 2050MB  
 (e) 8192MB

56. Consider the file system described in question 55. Ignoring the i-node access, how many disk blocks (including any index blocks) will have to be accessed to seek to and read byte number 1,000,000 in the file?
- (a) 1
  - (b) 2
  - (c) 3
  - (d) 4
  - (e) None of the above
57. Consider a UNIX file system with a disk block size of 512 bytes which uses i-nodes with triple-indirect. Each disk block pointer is 4 bytes long and the i-node contains 15 block pointers in total (12 direct block pointers, one single indirect, one double indirect and one triple indirect). Ignoring the i-node access, how many disk blocks will have to be accessed to seek to and read byte number 8,432,100 in the file? (You may assume the file is at least this many bytes long.)
- (a) 1
  - (b) 2
  - (c) 3
  - (d) 4
  - (e) 5
58. Consider a system which uses byte addressing with page frames of size 4 kbytes. If a process' page table is as shown below, which of the following virtual addresses will result in a page fault?

| Page | Page Frame    | Valid? |
|------|---------------|--------|
| 0    | 4             | Yes    |
| 1    | 10            | Yes    |
| 2    | Not in memory | Yes    |
| 3    | 0             | Yes    |
| 4    | 3             | Yes    |
| 5    | 0             | No     |
| 6    | 0             | No     |

- (a) 0
  - (b) 5000
  - (c) 10000
  - (d) 13000
  - (e) 23000
59. In a virtual memory system, what's the maximum number of page table entries (PTEs) that are needed if the virtual address size is 40 bits and the page size is 16kbytes?
- (a)  $2^{14}$
  - (b)  $2^{17}$
  - (c)  $2^{23}$
  - (d)  $2^{26}$
  - (e) None of the above

60. Given a 32-bit virtual address space and a 30-bit physical address space and a page table entry size of 4 bytes, what's the smallest page size that will ensure the size of a process' page table never exceeds 1 Mbyte? (Assume a single level page table scheme.)
- (a) 1kbyte
  - (b) 4kbytes
  - (c) 16kbytes
  - (d) 128kbytes
  - (e) None of the above
61. In a virtual memory system, what's the maximum number of page table entries (PTEs) that are needed if the virtual address size is 36 bits, the physical address size is 32 bits and the page size is 4kbytes?
- (a)  $2^{20}$
  - (b)  $2^{22}$
  - (c)  $2^{24}$
  - (d)  $2^{28}$
  - (e) None of the above
62. Consider a system which uses byte addressing with page frames of size 2 kbytes. If a process' page table is as shown below, which of the following virtual addresses will result in a page fault?

| Page | Page Frame    | Valid? |
|------|---------------|--------|
| 0    | 0             | No     |
| 1    | 3             | Yes    |
| 2    | 6             | Yes    |
| 3    | Not in memory | Yes    |
| 4    | 4             | Yes    |
| 5    | Not in memory | Yes    |
| 6    | 0             | No     |
| 7    | 0             | No     |

- (a) 2000
- (b) 4000
- (c) 5000
- (d) 8000
- (e) 10000