hw3: Dynamic Memory

Due Mar 10 at 11:59pm **Points** 8 **Questions** 8
Available Mar 2 at 12am - Mar 11 at 11:59pm **Time Limit** 40 Minutes
Allowed Attempts 2

Instructions

Read about Free Block Footers and the p-bit (previous block allocated bit)

and wait until after Thursday of Week 6 to complete this quiz.

This quiz was locked Mar 11 at 11:59pm.

Attempt History

	Attempt	Time	Score
KEPT	Attempt 2	28 minutes	8 out of 8
LATEST	Attempt 2	28 minutes	8 out of 8
	Attempt 1	33 minutes	7 out of 8

Score for this attempt: **8** out of 8
Submitted Mar 10 at 6:28pm
This attempt took 28 minutes.

Question 1

1 / 1 pts

1. An allocator [Select] move allocated blocks to the end of the heap to improve memory utilization.
2. An allocator [Select] skip bytes at the front of the heap to meet memory alignment requirements.
3. An allocator cannot reorder allocate requests to improve heap memory utilization.

4. An allocator [Select] use the data segment to satisfy heap requests.
5. An allocator [Select] create a larger free block by coalescing adjacent free blocks when needed.

Answer 1:

Correct! should not

Answer 2:

Correct! should

Answer 3:

Correct! cannot

Answer 4:

Correct! cannot

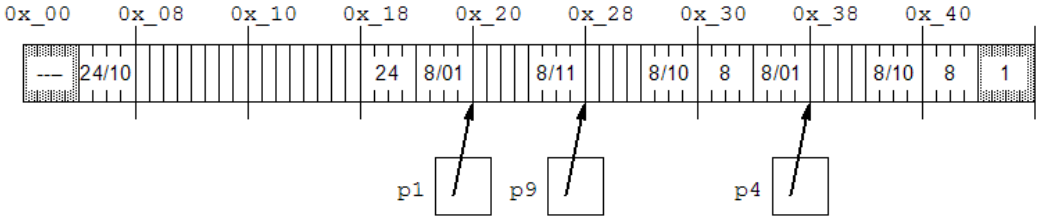
Answer 5:

Correct! should

Question 2

1 / 1 pts

Given the following diagram of a heap using block headers with both p-bits and a-bits and requiring double-word alignment:



If immediate coalescing is used, what is the new free's block header after the execution of:

```
free(p9);
free(p1);
```

Use the same format for your answer as shown in the diagram above "size/bits" without any spaces and no quotes.

Correct!

48/10

orrect Answers

48/10

Question 3

1 / 1 pts

I set the top of the heap for a program to the address that is passed to me as an argument. Who am I?

- sbrk()
- malloc()
- calloc()

Correct!

- brk()
- realloc()

Question 4

1 / 1 pts

Which of the following contribute to internal fragmentation?

Select **ALL** the correct answers.

Correct!

- block headers

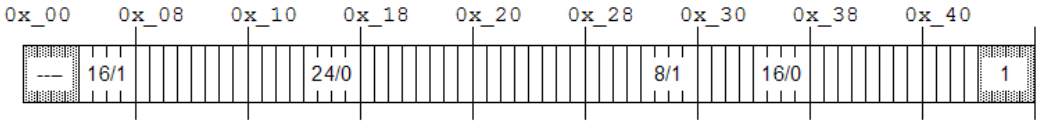
- [ ] block payloads
- [x] block padding
- [ ] adjacent allocated blocks
- [ ] adjacent free blocks
- [ ] non-adjacent free blocks

Correct!

Question 5

1 / 1 pts

Given the following heap diagram using block headers with only a-bits, requiring double-word alignment, and using a **best-fit** placement policy:



If the block at address 0x_2C was the most recently allocated, what address is assigned to `ptr` for the heap request below:

```
ptr = malloc(sizeof(int));
```

Use the same format for your answer as shown in the diagram above "0x_NN" without any spaces, no quotes and where N is a digit.

0x_38

Correct!

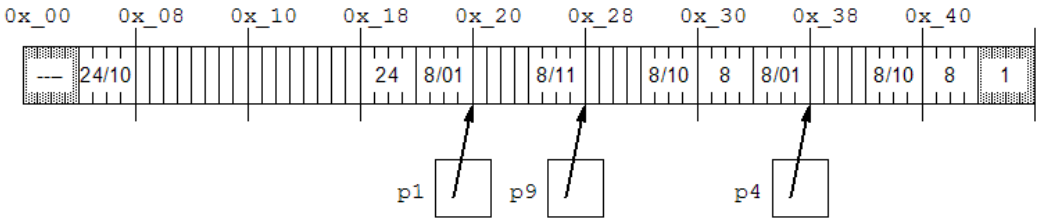
orrect Answers

0x_38

Question 6

1 / 1 pts

Given the following diagram of a heap using block headers with both p-bits and a-bits and requiring double-word alignment:



If **best-fit** placement policy with splitting and immediate coalescing is used, what is `p11`'s block header after the execution of:

```
free(p9);
p11 = malloc(2 * sizeof(int));
free(p1);
```

Use the same format for your answer as shown in the diagram above "size/bits" without any spaces and no quotes.

Correct!

16/01

orrect Answers

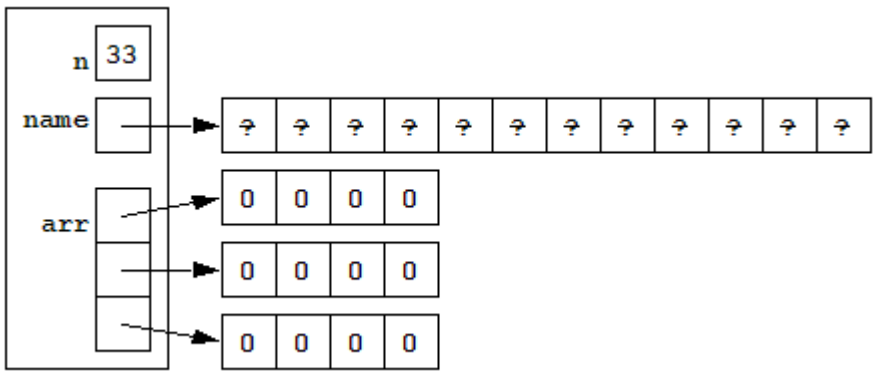
16/01

Question 7

1 / 1 pts

Given the following structure:

```
struct Data {
        int n;
        char* name;
        int* arr[3];
};
```



Which of the following code fragments dynamically allocate the memory as shown in the diagram above?

1)

```
struct Data *sptr = malloc(sizeof(struct Data));
if (sptr == NULL) {
        printf("Unable to allocate memory.\n");
        exit(1);
}
sptr->n = 33;
sptr->name = malloc(12 * sizeof(char));
for (int i = 0; i < 3; i++) {
        sptr->arr[i] = malloc(4 * sizeof(int));
        if (sptr->arr[i] == NULL) {
                printf("Unable to allocate memory.\n");
                exit(1);
        }
        for (int j = 0; j < 4; j++)
                *(sptr->arr[i] + j) = 0;
}
```

2)

```
struct Data *sptr = malloc(sizeof(struct Data));
if (sptr == NULL) {
        printf("Unable to allocate memory.\n");
        exit(1);
}
sptr->n = 33;
sptr->name = malloc(12 * sizeof(char));
if (sptr->name == NULL) {
        printf("Unable to allocate memory.\n");
        exit(1);
}
for (int i = 0; i < 3; i++) {
        sptr->arr[i] = malloc(4 * sizeof(int));
        if (sptr->arr[i] == NULL) {
                printf("Unable to allocate memory.\n");
                exit(1);
        }
        for (int j = 0; j < 4; j++)
                *(sptr->arr[i] + j) = 0;
}
```

3)

```
struct Data *sptr = malloc(sizeof(struct Data));
if (sptr == NULL) {
        printf("Unable to allocate memory.\n");
        exit(1);
}
sptr->n = 33;
sptr->name = malloc(12 * sizeof(char));
if (sptr->name == NULL) {
        printf("Unable to allocate memory.\n");
        exit(1);
}
for (int i = 0; i < 3; i++) {
        sptr->arr[i] = malloc(2 * sizeof(int));
        if (sptr->arr[i] == NULL) {
                printf("Unable to allocate memory.\n");
```

```
                exit(1);
        }
        for (int j = 0; j < 2; j++)
                *(sptr->arr[i] + j) = 0;
}
for (int i = 0; i < 3; i++) {
        sptr->arr[i] = realloc(4 * sizeof(int));
        if (sptr->arr[i] == NULL) {
                printf("Unable to allocate memory.\n");
                exit(1);
        }
}
```

- 1 only
- 1 and 2
- 2 and 3

Correct!

- (selected) 2 only
- 3 only

Question 8

1 / 1 pts

If an allocator is unable to get more heap memory from the OS to satisfy a heap request what is the next action that it should take?

- Call the function sbrk()
- Coalesce adjacent free blocks
- Return -1
- Call the function realloc()

Correct!

- (selected) Return NULL

Quiz Score: **8** out of 8